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COST ACCOUNTING
FOR CONTROL

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COST ACCOUNTING FOR CONTROL

BY

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Second Edition
Eighth Impression

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PREFACE

This work is the second edition, considerably revised and enlarged, of the book formerly entitled "Industrial Accounting." It contains a discussion of the new problems presented under the N.R.A. New material has been added also for the purpose of increasing its usefulness for teaching purposes; most of this is either additional explanation and illustration, or more exercise material, especially in three new practice sets. In quantity the additions extend to 6 new chapters, 40 new forms, and more than 140 pages of text matter. It is hoped that these will serve both to give a more complete picture of cost practices in industry and to smooth the path of the student who seeks to become acquainted with them. Three chapters of the former materials have been omitted. The same basic point of view has been retained, namely, that the meaning and uses of costs for management purposes are more important than matters of technical procedure, though both should be sought for.

It is desirable from time to time in any science to make a restatement of principles in the light of added experience, and this is particularly true of subjects as little stabilized as are most branches of business science. The writer is among those who believe in the value of case materials for teaching purposes, and a good deal of such matter has been incorporated here, both as practice material and also by way of illustration. It is hoped that these will serve to give a practical aspect to the exposition of general principles.

Cost accounting is no longer looked upon as consisting merely of adding up the elements of cost to a total, and all cost accountants worthy of the name know that cost figures are not matters of arithmetical finality. They are analyses and summaries based on certain assumptions and they are only as good as the assumptions on which they rest. For different purposes, moreover, different assumptions may be made and different results obtained. Cost accounting is a tool for developing information which will throw light on many internal and external managerial problems of business, and it is this assistance rendered to management which makes cost accounting a worth-while subject for study. The typical procedures used in practice are explained in this book, but its major purpose is to show the chief ways in which cost accounting can be useful in helping to solve some important business problems. Moreover, the man who can see beyond the technical processes to the business problems involved and can draw out of the cost figures some contribution to the solution of those problems is well on the way to being a business executive.

THOMAS HENRY SANDERS.

BOSTON,
April, 1934.

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PART I

CONTROL THROUGH RECORDS

I

COST ACCOUNTING AND FINANCIAL CONTROL

Costs and the Three Business Functions

Cost accounting is the analytical study of the expense incurred in carrying on any business; the study is made for the purposes, first, of comparing the several cost elements with certain standard figures; later, of comparing these costs with the resulting values received in products or services; and, ultimately, of comparing them with the income made by selling the products. Such cost analysis is useful not only in a manufacturing concern but in every type of business. Trading companies of all sorts, wholesale and retail, are becoming more and more anxious to know more about the elements of cost which they incur for buying and selling, and banks often make studies of their costs of doing business.

In considering only the manufacturing costs of the individual business, however, the results of cost accounting work may be used in considering policies connected with all three of the major business functions, finance, production, and marketing. Without cost data the financial control is inadequate and insecure, production control is unintelligent, and marketing operations lack one of their most important guides.

Profits Essential to Continued Success

The final test of a business enterprise is that it shall yield a profit. In a manufacturing business this means that the product must be manufactured at such a cost that it may be sold in the market at a profit. But what is true of the product as a whole is true of every process, every operation, every plan of management; in the last analysis, they must all be tested on a cost basis. That method which will give the desired result at least cost is the method which will survive, displacing other and less economical procedures. True, there are other measures of accomplishment, such as quantity of output, quality of output, and machine speeds; but these must all be related to cost, because in the end cost will control. Every plan of management, whether "scientific" or otherwise, must stand or fall according to the showing it makes in terms of unit costs, as compared with other methods.

Thus the test of cost accounting applies to every phase of the manufacturing operations. It is commonly considered that the principal object is the computation of the cost of the finished product, and this is indeed one of the most important duties of the cost department. But to determine the cost of the product is only a small part of the work; the costs of specific operations or processes are also desired, and these must be presented in such form that they may be summarized to show total costs of departments and of the plant as a whole. In this way the cost records furnish the material for the financial control of the manufacturing operations. They show the general management what it is getting for the money it spends on manufacturing operations, and they ought to give this information in a way to indicate whether or not the results shown are satisfactory, and, where they are not satisfactory, what reasons have caused this.

Responsibility for Profits Is on General Executives

The primary responsibility for earning a profit is upon those general executives who control and coordinate the three major functions of finance, production, and distribution. No one of these operations can by itself produce a profit; although it is commonly said that a profit can exist only in a sale, yet even a sale cannot show a profit on goods which have been uneconomically produced. Moreover, one of the first things to be learned in business is that it can rarely be said that a profit is made on any single sale for a single item of merchandise; it is on the sum total of all business done that a profit becomes possible, and then only after certain large items of cost have been covered. It is therefore only by the united efforts of all departments that the profit is earned, and it is the general executives who must direct and coordinate those efforts.

Financial Accounting Their Chief Guide

In the discharge of this responsibility the general executives will find their chief guide in the financial accounts, and especially in the operating statement which shows the costs and income from doing business, and the balance sheet which shows them their present financial condition. In most industries it is now considered essential to good management that the directors and chief officers should receive these two statements once a month, and the accounting work is organized to make this possible. Even more frequent reports are common in some businesses, covering some of the more important features, if not the complete results of all operations.

Where Financial Accounting Fails to Inform

Financial accounting, as commonly understood, however, omits certain large classes of information which are essential to a complete knowledge and understanding of the situation. Ordinarily only the external transactions of the business, its dealings with the world outside, are dealt with in the financial accounts; on the one hand, its outlays for materials, labor, and other expenses are recorded, and, on the other hand, its income from sales is shown. Between these two groups of transactions lies the whole range of manufacturing operations, involving all the costs of converting raw materials into finished goods ready for sale. Unless these operations are economically performed, the total costs of the finished product will mount up to the point where a profitable sale is impossible. The ordinary financial accounts will not, however, indicate this condition until the whole series of operations has been completed, the goods are sold, and it is too late to change the results. This is the sort of accounting which is sometimes referred to as "post mortem"; as a matter of fact, the annual balance sheet and income statement have some very important uses, especially for creditors and stockholders, but for controlling the business, in the sense of directing its course and securing the desired results, it is obvious that more immediate and more detailed information is necessary.

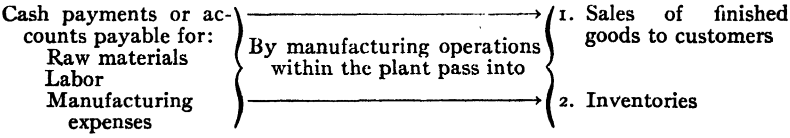
Financial Accounting and Cost Accounting

It is this information about internal operations that the cost records are designed to supply. The cost accounts take up the outlays recorded in the financial records, connect them with the manufacturing and selling objects they are designed to accomplish, and so trace at every step the values received, as compared with the costs. This involves an analysis of every expenditure in terms of the purposes it is intended to serve, and a regrouping or assembling of all items of cost which relate to the same function or product, in order to ascertain the total cost of that function or product. It is then possible to measure this total cost against the financial returns obtained as income from the sale of the product, or against other methods of performing the same function. A financial gage or measure is thus put upon every step in the processes which take place between the first incurring of expenditures and the ultimate realization of an income from them.

Consider, for example, a plant in which machine tools are made; the manufacturing departments consist mainly of a foundry and a machine shop; there are, however, the general offices, the sales department, the works offices, a drafting or designing room, and a power plant. The management will wish to know how much each of these departments is costing; but only the foundry and machine shops are working directly on products to be sold to customers, and the other departments are auxiliary or indirect departments. The total cost of each indirect department having been found, therefore, and having been examined as to its reasonableness, it will be divided between the foundry and machine shop in proportion as it is found, upon analysis, to serve each of them respectively. The total cost of the foundry and of the machine shop will then be known, and it will be possible to make a computation of the cost of the individual items of product which pass through these departments, including direct charges and the cost of service departments.

Place of Cost Accounting

This discussion of the place and function of cost accounting may be made more clear by considering the following figure:


Cash payments or accounts payable for:
Raw materials
Labor
Manufacturing expenses
By manufacturing operations within the plant pass into
1. Sales of finished goods to customers
2. Inventories

The foregoing figure illustrates, on the left side, how expenditures are made for raw materials, labor, manufacturing supplies, and other expenses. In all these transactions the company comes in contact with the outside world; these transactions will therefore be recorded in the financial accounting books. On the right side of the figure are sales of finished goods to customers; these also involve contacts with people outside the business and will therefore also be recorded in the financial records. In order to complete these financial records for purposes of making the balance sheet and operating statement, inventories must be found. Thus far, all the records mentioned are nothing more than would be required in any ordinary system of accounting.

But in between the transactions on the left and the transactions on the right lies the whole body of manufacturing operations. In the course of these operations the raw materials, labor, and manufacturing expenses arising on the left will be applied on specific products, in specific operations, and in definite departments. The materials are likely to go through a series of these operations. It is as a result of these operations that they emerge at the end as finished goods ready for sale, or as inventories still on hand. If there is no cost accounting, there will be no record of these operations; but it is the purpose of cost accounting to take these expenditures and attach them to specific goods made and sold, or still on hand to be listed in the inventories. In other words, the financial accounting may indicate the final result of operations in profit or loss; but if they do not follow the manufacturing operations step by step, in the middle part of the foregoing figure, it is not possible to discover exactly where and how these profits and losses have arisen.

Inventory Values

Another important result of cost work is the fixing of values upon inventories of work in process and finished goods. When the analysis described in the preceding paragraph has been completed, not only do the resulting figures, when compared with other figures for the same thing, afford a measure of accomplishment but the total costs thus assigned to the various products become their value; the expenditures made to produce them are regarded as being converted into the finished products. The same is true also of work in process; the cost records may show at any moment the amount of material, labor, and expense so far put into those goods, and the total cost is the value of them at that point. If market conditions have changed so that current prices for material and labor are less than those shown in the cost records, then for purposes of preparing a balance sheet the lower or current values will be used; except for this condition, however, the value of finished or partly finished goods is simply the sum total of their cost, and one main purpose of the cost records is to show this total at all times. It is generally recognized that an important element in the financial control of manufacturing is a constant regulation of the inventory, with a view to seeing that the largest possible volume of business is done on the smallest possible inventory, thus keeping the ratio between inventory and sales as low as possible. Inventories of raw materials are also included in these plans.

Protection of Investments

One of the important duties of the management of a business is to maintain the investment in it, to preserve from loss the funds invested by the proprietors. It is not a difficult matter to make regular provision for the replacement of losses caused by ordinary wear and tear upon the assets; to cover these costs out of current revenue is one of the first principles of accounting and of sound business. But a more difficult and dangerous situation arises when, owing to changes in fashion or the progress of invention, a business finds its product superseded in the market, or its methods of manufacture rendered obsolete by new inventions, or its position powerfully affected by some other development, such as a general decline in fixed asset values. The rate of invention is increasingly rapid, and management must be correspondingly more alert for changes which may react unfavorably upon its business. The cost records may be made use of for this purpose also, not only to help to indicate the presence of unsatisfactory symptoms by showing cost figures out of line, but also to measure the relative costs of new devices or new methods. This point is discussed further in the following chapter; it is here only necessary to emphasize the duty of general management, in connection with their financial responsibilities, to preserve the integrity of the capital invested in the business—an increasingly hazardous task for which they should avail themselves of every assistance.

Attitude of Bankers

One other point deserves notice. The financial administration of any business includes the maintenance of satisfactory relations with the bank. Probably the majority of businesses require banking accommodation at some time, and many need it regularly; for all of these a sympathetic attitude on the part of the banker is a necessity. The day is past when an occasional balance sheet, presented when a loan is needed, is sufficient to maintain these relations; in addition to its formal information files, a bank is now likely to pay attention to matters of internal administration and control of a business. Not that it wants to meddle with the management, but it does desire to assure itself that an adequate accounting control is present, that the manufacturer knows his costs, and that he receives prompt, regular, and complete reports on his business operations. The active influence of banks is exerted in favor of these things, not only through the credit or loan department but frequently also through an officer specially detailed to act in this capacity, giving advice and assistance to the bank's customers, and at the same time securing useful information for the bank. Frequently a bank is in a position to advise a customer whether his organization or costs compare favorably with others in similar lines of business, and the business man should be willing to avail himself of such advice.

The Comptroller Exercises Accounting Control

These ideas of control through accounts are well illustrated by considering the activities of the typical comptroller in modern business. He is the officer who, in most large corporations, exercises the functions described in this book. It is therefore worth while to study for a moment the work of the comptroller and the qualifications necessary for success in that office.

There are three phases in the work of the comptroller. First, he must be a competent and well-trained accountant, in the sense that he understands the technique of the subject, knows double entry, how to use ledgers and journals and all the auxiliary records, and how to draw sound and accurate financial statements from them. Second, he is an executive in charge of a department and in this capacity must be able to organize his staff effectively and economically. It is usually best to have all the accounting work under him, including cost records and all subdivisions; in many places all office work, such as billing, handling orders, and the like, are placed under the comptroller, in addition to the accounting work proper. This means that he is called upon to plan and organize the work, allocating tasks to the various individual members, and securing a smooth flow of operations. In all these matters he resembles a foreman or superintendent in the plant; his success will depend upon his ability to handle people and to organize them into an effective working force.

But the third aspect of his work requires still more executive ability. The comptroller is required not only to know good accounting and to be able to organize the accounting and office work, but also to know enough about business management to be able to utilize what may be learned from the accounting reports in the better management of the business. This will take the form very largely of encouraging economy in all stages of the business operations, and in this his principal instrument may be the business budget, as is described later. There are many examples in practice of comptrollers who are able in this way to use the knowledge they gain from the accounts in the better management of the business, and in interpreting the records to the directors and officers. In these circumstances the accountant becomes a real business executive.

Summary

The financial policy of a business is in the hands of the general management, who must watch carefully over all expenditures, observe and develop all sources of income. These two factors are well displayed by the ordinary financial accounts; but it is necessary in addition to keep track of operations within the business itself, of the different stages in the processes of converting raw materials into finished goods, of the actual outlays compared with reasonable standards, of the money invested in inventories, and of all developments which may affect the safety of the capital invested. One of the principal aids in the control of these matters is found in a set of cost records which, supplementing the regular financial records, will reveal unsatisfactory conditions before they have gone too far. In this way the safety both of the capital and of the income will be increased.

QUESTIONS AND PROBLEMS

1. Name some of the dangers to which a manufacturing business is exposed, and indicate briefly how cost records may help to guard against them.
2. What do you consider to be the relation between cost accounting and financial accounting?

3. The Magnum Machine Tool Company has two main departments, a foundry and a machine shop. Below is the trial balance as of November 30, 1928, at the end of eleven months of operations:

THE MAGNUM MACHINE TOOL COMPANY
TRIAL BALANCE, NOVEMBER 30, 1928

Cash	$ 32,800	
Notes Receivable	17,350	
Accounts Receivable	49,280	
Reserve for Bad Debts		$ 1,400
Inventory, Metals	22,850	
Fuel	14,730	
Other Raw Materials	6,960	
Work in Process, Foundry	13,370	
Work in Process, Machine Shop	21,460	
Finished Stock	14,810	
Office Supplies	1,720	
Machinery and Equipment	184,500	
Reserve for Depreciation, Machinery and Equipment		25,780
Buildings	42,800	
Reserve for Depreciation, Buildings		17,250
Land	25,000	
Notes Payable		22,000
Accounts Payable		31,180
Capital Stock, Common		300,000
Surplus		46,800
Profit and Loss		
Dividends		
Purchases, Metal	185,360	
Fuel	97,730	
Other Raw Materials	32,560	
Inward Freight	44,670	
Sales		855,120
Returns and Allowances on Sales	3,690	
Direct Labor	177,830	
Indirect Labor	74,490	
Salaries, Factory	28,560	
Purchased Power	11,740	
Property Taxes	4,670	
Depreciation	10,280	
Insurance	3,950	
General Manufacturing Expense	12,730	
Maintenance and Repairs	10,000	
Advertising	9,250	
Sales Salaries and Commissions	19,480	
Traveling Expenses	6,790	
Packing Expenses	14,250	
Outward Freight	29,360	
Officers' Salaries	34,450	
Office Salaries	16,250	
Office Expense	19,830	
Interest Expense	1,270	
Loss from Bad Debts	980	
Discount on Purchases		5,490
Discount on Sales	7,220	
	$1,305,020	$1,305,020

During December transactions were as follows: Purchases of metals, $14,760; of fuel, $8,240; of other raw materials, $2,730, all on account; inward freight paid, $4,730; sales, on account, $81,290; allowances on sales, on account, $270; expenses paid in cash: direct labor, $15,390; indirect labor, $6,730; factory salaries, $2,950; power, $1,090; general manufacturing expense, $1,360; maintenance, $1,040; advertising, $890; sales salaries and commissions, $1,870; traveling expense, $670; packing expenses, $1,380; outward freight, $2,750; officers' salaries, $3,290; office salaries, $1,630; office expense, $1,790; office supplies purchased, $210.

The following additional provisions were found necessary at the end of the year: Depreciation on machinery and equipment, $750; depreciation on buildings, $240; reserve for bad debts, $90; interest expense accrued, $110 (credit Accounts Payable).

Cash received on account, $78,290; discounts allowed to customers, $650; cash paid on account, $26,470; discounts taken, $480; notes received to settle accounts, $5,400.

a. Prepare a 10-column statement, in form as follows:

Account name	Trial balance November 30, 1928		December transactions		Trial balance December 31, 1928		Balance sheet		Income statement	
	Dr.	Cr.	Dr.	Cr.	Dr.	Cr.	Assets	Liabilities	Costs	Income

Enter the accounts, and the November 30 balances; enter the December transactions, and fill in the trial balance for December 31, before recording the inventories below.

b. Complete the balance sheet and income statement columns, using the following inventories as of December 31; the inventories already in the books are for January 1, 1928:

Inventory, Metals	$20,330
Fuel	15,270
Other raw materials	6,420
Work in process, foundry	12,780
Work in process, machine shop	22,560
Finished stock	10,370
Office supplies	150

Charges to Property Taxes and Insurance are expenses. Save your solution for further use.

II

COST ACCOUNTING FOR OPERATING CONTROL

The Responsibility for Production

The duty of turning out the product in the quantity desired falls on the factory executives, who may include a works manager, divisional superintendents, and the foremen, assisted perhaps by a number of others performing special functions, such as planning and routing. Their work has two main aspects: the first is that of organization and administration, in which they have to form and execute plans for the ordering of work, the handling of materials, dealing with labor, and so forth; the second is the technical aspect, involving a knowledge of engineering processes and of the physical properties of the materials with which they deal. The ability to handle these two sides of their work effectually is not always found in one and the same man, and it frequently happens that the technical aspects, and a scientific interest in the processes themselves, lead a production executive to overlook the profit and loss issues attaching to the operations going on under his guidance. It is desirable to keep the financial aspects constantly in mind, and cost analyses should be made at frequent intervals to serve as a guide and measure of the principal factors.

Point of View of Factory Executives

In preparing cost reports for production men, however, special attention should be paid to the matters in which they are interested, and for which they are responsible. Factory officials want, above all things, to have information upon matters under their control promptly, in order that they may take immediate steps toward a remedy for anything that goes wrong. The regular accounting reports, prepared sometime after the end of the period covered, are not of primary interest to the production men; to be of service to them, reports must relate to specific lots of material which were defective, or to specific jobs on which the time worked was excessive, or to specific items of expense which have run out of line. Information on such matters, sent to a foreman within 24 hours of the events covered, makes it possible for him to attend to all conditions which require his intervention. The same information, in summarized form, could be supplied to divisional superintendents and the works manager at somewhat less frequent intervals and would enable them to exercise an effective supervision over the foremen. In other words, the minds of factory executives run upon the actual physical operations going on under their supervision; it is desirable to impress upon them the financial importance of these operations; but in order to do this in any effective way, they must be supplied with data which are specific in their application to actual men, actual materials, and actual jobs.

Standard Figures for Departments, Operations and Processes.

The expression "costs out of line" has several times been used to indicate matters requiring the special attention of executives. In order to judge when costs of production are out of line it is, of course, necessary to have a standard by which the facts can be judged; a normal satisfactory performance must be determined, so that anything unusual may at once be observed. All available information will be used to determine these standards, but chiefly they will be derived from the accounting records of expenses in the past, upon a careful analysis of these expenses for the purpose of allocating them to different departments and operations, upon time studies made upon specific operations, and upon their determination of figures of normal output per man, per machine, or per department. It is worth while to give careful attention to the determination of these standards; by so doing it is often possible not only to arrive at reliable standard figures but also, what is equally important, to determine at which points the measurements or tests should be applied, and to discover the most simple methods of making the tests. One of the distinguishing features of well-managed concerns is that they have developed methods of testing their results at all crucial points with astonishing rapidity and simplicity; a few crucial figures show at a glance whether or not all is well. But this simplicity should not deceive anybody; the methods of testing were probably devised as a result of long and careful studies of all the factors involved.

The Progress of Mechanical Invention

The rapidity with which changes and improvements are made in methods of manufacture is quite surprising to anyone who discovers it for the first time; in all manufacturing plants short cuts for performing the same operations, or methods of omitting them all together, are constantly being devised. Studies in metallurgy result in continual changes in the processes for the heat treatment of metals, and in the specifications for tool steel. The use of the oxyacetylene torch for cutting metals, in place of machine tools, is a comparatively recent innovation but is becoming widespread. New materials and new combinations of materials are frequently substituted for old, with corresponding modifications in the processes to which they are subjected. These are but typical of innumerable changes which are taking place every day both in the technique and in the organization of industry. To every one of them two essential tests must be applied: (1) Will the new device work as well as or better than the old, and (2) will the new device cost more or less than the old? The first is an engineering question, and the second an industrial accounting question. Upon the combined answers to these two questions the merits of the new device, from a business point of view, will be determined.

Waste in Industry

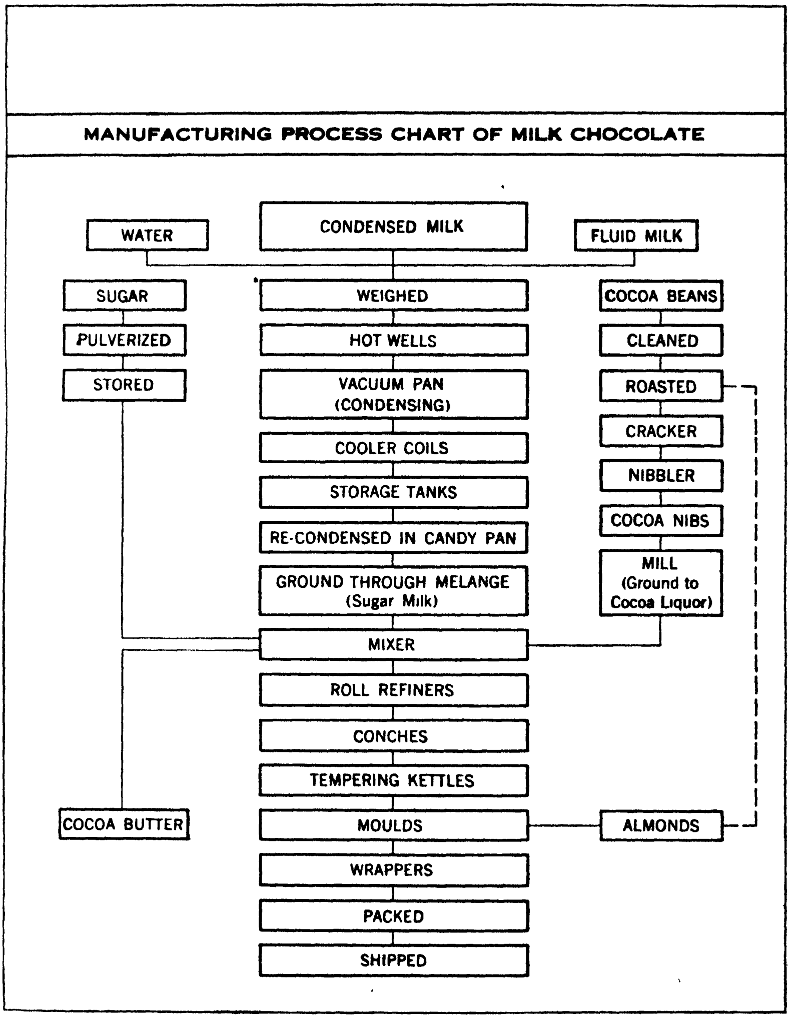
A great deal of attention has recently been given to the problem of waste in industry, and it is well for the business community to have its attention directed to this subject. It must, however, be remembered that waste is a relative term. There are several major classes of waste; besides wasting materials, it is possible to waste labor and the overhead expenses of a firm by improperly or insufficiently utilizing its personal and physical equipment. The ideal is, of course, that there shall be no waste in any of these things; but if waste arises at one point, care must be taken not to incur more waste at another point in trying to prevent it. If waste material results from certain processes, it is proper to inquire whether that waste may be prevented, or reduced, or how the waste material can best be utilized; but it is not profitable business to expend more money and labor in trying to reclaim it than can be realized on it. All questions of this sort, therefore, must be judged on a basis of comparative costs. The amount of the waste must be ascertained in terms of money, and the cost of the proposed methods of reclaiming it or of disposing of it must also be found. When this information is available, an intelligent course of procedure may be taken.

Growing Costs of Labor

Everywhere increasing costs of labor are being experienced, and if the present restrictions on immigration continue, as they doubtless will, it is likely that the growing scarcity of labor will have a constant tendency to increase wages. In these circumstances the pressure upon industrial leaders to employ labor-saving devices will become correspondingly greater. Intelligent direction of policies of this sort can come only from a study of the relative costs. This will reveal the proportionate amount of labor in the total cost of the product and the tendency for this item to increase or decrease; it will suggest whether alternative measures should be sought for and will indicate how much money is available for employing other methods. Here again progress must wait upon technical innovations by engineers, but, necessity being the mother of invention, the need for changes is shown in the costs.

Chart of Manufacturing Processes

One of the most useful devices in connection with working out a cost system for a manufacturing plant is a process chart which clearly shows all stages of the manufacturing operations. A well-prepared chart will show all the manufacturing operations in proper sequence, the flow and direction of work, the points at which material is held as inventory before going to a subsequent process, the amount of transportation between each two processes, and it may perhaps indicate whether the processes themselves and the transportation are mechanical or manual. Surprising results are sometimes brought to light in connection with the last-named point; a plant which is regarded as being predominantly mechanical and automatic may upon close study turn out to have a predominance of manual operations, excessive transportation between processes, and undesirably long stops of materials at certain points. It is of little use to organize a cost system for a manufacturer whose layout is faulty; to do so would mean that, when the bad practices were discovered



Form 1: Chart showing manufacturing processes arranged as a basis for cost records.

and corrected, considerable revision in the cost system would become necessary. It is better that the weaknesses in layout should be discovered and corrected first, and the cost system worked out on the basis of the improved conditions.

Form 1 is a process chart illustrating the manufacture of milk chocolate; it was prepared after all necessary reorganization of the manufacturing processes had been completed and was constructed to serve as a basis for cost accounting records and reports. For that reason it showed only the processes, and the materials entering into them, in consecutive order. A cost ledger account or a cost report or both would be prepared for each of the items in the chart, except that processes closely related in manufacturing might be combined in one report.

Standardization of Products

Another matter of considerable public interest is that of standardizing the products of industry. It is generally understood that, with articles of everyday usefulness, it is profitable in every way to use uniform sizes and shapes rather than to have a great diversity. This conduces to cheapness in manufacture, to cheapness in repair and maintenance, to cheapness in storage and marketing, and to convenience everywhere; but the very statement of these advantages indicates clearly that the test or measurement of them is an accounting problem. What are the relative costs and profits upon a few standard models as compared with the results from numerous diversified models, having regard to the possible reduction in sales? The cost portions of this information must be furnished by the cost accountants, though they will need information from other sources to assist their computations; for example, the volume of business which can be done under the different circumstances is an essential consideration, and so is the manufacturing program which would be followed under the proposed changes. It is generally expected that the fewer designs will be produced at so much cheaper cost than the more numerous designs that the total volume of business done will be greatly increased, making still further economies possible; because the introduction o specialized machinery, like the division of labor, is limited by the extent of the market.

Engineers' Estimates

In all the new enterprises which have been discussed in the preceding paragraphs, engineers are frequently important —if not controlling—agents. They make the new inventions, install the new equipment, supervise the new construction, and so forth. In connection with their work it is necessary for them to make the estimates of cost to which reference has constantly been made. They must, therefore, either themselves have knowledge of the principles of sound cost accounting or else must have the assistance of others who have such knowledge. A certain amount of conflict arises between men, on the one side, who are interested primarily in the engineering aspects of the work and men, on the other side, who are familiar more especially with the accounting aspects. For a successful determination of business policy it is necessary, in any given case, that these men learn to understand each other's point of view, in order that they may be agreed not only as to the technical expediency of the proposal but also as to its business profitableness.

Long-time and Short-time Point of View

In order to win any degree of permanent success, therefore, a manufacturing concern must not only be efficient in its day-to-day operations; it must also be far-sighted and keep abreast of the times, if not in the van of progress. It is useless to be economical in little things if some chronic trouble is present in the structure of the organization or in the product. Nor should the main endeavors be to remove troubles but rather to use foresight which will anticipate and avoid them by means of an active policy of development and improvement. The higher officials should therefore be free enough from petty details to be able always to take a long look ahead, to conjecture what changes in product, machinery, buildings, or organization may be feasible or desirable. When certain possibilities have been thought of and are under consideration, the cost reports should be made regularly to include data which will throw light on these projects, in order gradually to build up a body of sound information and ideas about them; then when action becomes necessary in any of these important matters, a matured judgment will be ready to be applied to them, thus avoiding hurried and ill-considered action.

Summary

It is thus seen that in all business activity cost accounting is one criterion of whether a certain method or product is desirable or not. Cost accounting may be regarded as the commercial instinct or commercial judgment applied to engineering and production enterprises. Without the information that cost accounting supplies, business judgment is without a standard of measurement and without guides. All the very large and outstanding business concerns of the country do in fact give great attention to the ascertaining of correct cost information; in small concerns personal inspection and supervision sometimes achieve some of the results otherwise obtained by cost accounting. In some instances unique products, or unique methods of selling them, are relied upon to produce a satisfactory revenue, regardless of cost, but in all cases definite knowledge of costs is essential to a clear understanding of business problems and to a satisfactory judgment upon them.

QUESTIONS AND PROBLEMS

1. Discuss briefly some of the characteristics of cost reports prepared for factory executives.

2. A shoe factory found it more and more difficult to compete in the market with other manufacturers; its product seemed satisfactory but its costs were high and tended to increase. What principal facts should a cost investigation seek to establish, and what conclusions might be drawn from them?

WORK IN PROCESS

	Foundry	Machine shop	Total
Direct Labor	$108,730	$ 84,490	$193,220
Indirect Labor	49,360	31,860	81,220
Salaries, Factory	14,150	17,360	31,510
Purchased Power	5,280	7,550	12,830
Property Taxes	1,950	2,720	4,670
Depreciation	4,770	6,500	11,270
Insurance	1,640	2,310	3,950
General Manufacturing Expense	8,360	5,730	14,090
Maintenance and Repairs	5,540	5,500	11,040
Total	$199,780	$164,020	$363,800

3. In Question 3, pages 11–12, can you tell the value of materials used during the year in manufacturing? If so, how? If not, why not? What information about materials do you consider should be provided, if the cost records are complete?

4. From the working sheet prepared in response to Question 3, pages 11–12, prepare a balance sheet and income statement; in the latter include

columns for the month of December and for the entire year 1928. Inventories on November 30 were the same as on December 31.

5. In the trial balance on page 11, the accounts from Direct Labor to Maintenance and Repairs, inclusive, are regarded as the manufacturing expense accounts and therefore are closed into the work in process accounts for the two departments. The division of these accounts, as on December 31, 1928, between the two work in process accounts is as shown in the table on page 20.

The Inward Freight account is closed into the purchase accounts as follows:

To Metals	$28,690
To Fuel	16,120
To Other Raw Materials	4,590
Total	$49,400

The entire finished product of the foundry was transferred to the machine shop. Show in full the following accounts, as they would appear in the ledger after being closed for the year:

Purchases, Metals
Work in Process, Foundry
Work in Process, Machine Shop
Finished Stock
Sales
Profit and Loss

III

COST ACCOUNTING AND SALES POLICIES

Cost of Production and Selling Price

It is frequently asserted that selling prices are fixed by market conditions, and that cost of production has nothing to do with them; the argument is sometimes used to imply that the gathering of costs is a useless procedure which can have no influence upon actual business policy. The contention overlooks the well-known economic fact that it takes two sides to make a market, the supply and the demand, and that cost of production constitutes what is known as the "supply price." As Marshall says, "We might as reasonably dispute whether it is the upper or the under blade of a pair of scissors that cuts a piece of paper, as whether value is governed by utility or cost of production." Here "utility" is largely analogous to demand; it is the quality which causes goods to be wanted. But this want will be ineffectual unless there is a corresponding supply and, broadly speaking, there will be no supply except at a price which will cover the costs to the producers.

The Basic Argument

It is worth while for the cost accountant to consider the precise nature of the economic arguments respecting market prices and cost of production, and the basis upon which those arguments rest. The main idea is that, in the long run, cost of production does determine selling prices; if a commodity is to be continuously supplied in the market, those who want it must be willing to pay a price which will cover its cost of production, which, for the economist, includes a fair margin of profit to the producer.

If the prices set by competition fail, for any considerable period, to yield a satisfactory return to the producers, it is argued that the producers will curtail their output; if this process continues long enough, some producers will actually leave the industry. The economists refer to this as "transferring their capital" from one industry to another; it commonly occurs, however, that in such circumstances the producer will lose a large part of his capital and will make his exit from the industry by way of the bankruptcy courts.

Efficient and Inefficient Producers

At this point the economist refers to "submarginal" producers, the inefficient producers who are the ones expected to be driven out of the industry and thus leave a more prosperous business to the survivors. The measure of efficiency for this purpose is, however, found in the costs; the inefficient or submarginal producer is the one whose costs of production are higher than the selling prices fixed in the market by competition. Even if it be granted that these prices were wholly independent of cost of production, yet a knowledge of these costs would still have the advantage of indicating whether the particular business was one of those which were scheduled to survive, or one which was expected to go down. The company which found its costs above the price fixed by competition would know that it must, in order to survive, find means of reducing those costs.

Adjusting Supply to Market Prices

The complete removal of capital from an industry is, however, only the last resort; more commonly it is only for short periods that market conditions will set prices below the costs of production of many firms. These firms will then tend to curtail their production, and the stronger the firm, financially and otherwise, the more it will be able to resist the temptation to sell at losing prices. It is common knowledge that the more powerful steel corporations will close down their plants rather than sell below prices which they consider will give them a fair return for their outlays. For the industry as a whole this curtailment will usually be sufficient to restore market conditions to the point where a fair price is obtainable. Here again the cost of production measures the point at which curtailment becomes advisable; the costs do determine policy.

Still more common is the condition where, instead of curtailing all production because of low selling prices, the production only of those lines which are especially unprofitable is reduced. Frequently it is not possible to carry this policy to the extent of actually dropping unprofitable lines, because in many cases a manufacturer must supply a full line of goods or run the risk of losing business. But the situation can be improved by putting all the sales promotion work on profitable lines and merely taking such business as offers on unprofitable items.

Adjusting Selling Prices to the Demand

The reverse procedure to that discussed in the preceding paragraph takes place when the company decides to reduce prices in an effort to sell a larger part, if not the whole, of its production; this price reduction may appear like making a sacrifice, but if a greater volume of business is thereby done, a greater gross income may be received, and a greater part of the burden costs recovered. The great incentive to this policy is in fact the desire to obtain business which will make some contribution to the fixed charges or overhead, which continue even though operations cease entirely. It is believed by some people to be preferable to continue to produce if the goods can be sold at a price which will cover direct cost for labor and materials and make some contribution to the fixed charges. The wisdom of this procedure must, however, depend upon many considerations, including especially the question of its ultimate effect upon the market. If this policy should be widely resorted to, the market would become so demoralized that the time when profitable business could again be obtained would be greatly postponed.

At this point the distinction between the action of consumers' goods and that of producers' goods in this respect should be observed. The former term includes goods which are ready for use by the ultimate consumers; it is generally recognized that the demand for such goods may often be stimulated by a price reduction. The latter goods, however, such as factory machinery, are used by producers in making other goods; the demand for them depends on the demand for the products made from them, and price changes in such producers' goods are less likely to increase the sales of them. As economists say, the demand for producers' goods is in general less elastic than the demand for consumers' goods, though this is not always true.

Different Forms of Competition

It is generally found that the weaker firms are the first to resort to price cutting as a means of increasing their share of the business. The stronger firms prefer to rely upon a more vigorous selling policy, upon more skillful advertising, upon efficient production and maintaining the quality of their product, and in general upon attaining to a distinctive, if not a commanding, position in their line of business. And, as previously seen, if for a time these methods will not succeed, such firms are usually financially strong enough, and have sufficient accumulated surplus, to decline to operate for unprofitable returns; they have confidence that if they cannot sell at a profit their weaker competitors are probably still further weakening themselves if they continue to sell at the prevailing prices. It is, therefore, the general experience that competition by cutting prices is frequently the method of the weaker firms; the stronger rely upon the quality of their goods and upon the service they render to their customers as the best means of commanding their share of the available business.

A Representative Firm

One of the points for which the economist Marshall was noted was his concept of "the representative firm"; it is the cost of production of the representative firm, he said, which tends to determine market prices. A representative firm is one which is controlled and guided by good average business ability, with good average physical and financial equipment. Such a firm has no exceptional advantages; on the other hand, it is not one of those which will be likely to be forced out of business in times of depression.

If a representative company finds itself with an insufficient amount of business, it is likely that the majority of other companies in the same industry will be in a similar position; at such times there is a temptation to the individual firm to cut prices in order to increase its share of the total business available. Here again, however, the company may by such methods do itself more harm than good, by postponing the day when more profitable prices will prevail.

If, on the other hand, a company finds that it is unable to get a reasonable amount of business at a time when other concerns in the same line are prosperous, it is likely that there are certain quite definite troubles with that unfortunate firm. In such case the cutting of prices is obviously not the remedy; the troubles must be discovered and removed. If the quality of the product is not satisfactory or the company's advertising ineffective or its costs of production wasteful and inefficient, cutting prices will in the long run only aggravate its difficulties instead of removing them.

Cost and Selling Price Both Vary

Another fact which contributes to the impression that there is little, if any, relation between cost and selling price is that both of these quantities are variable in themselves. Not only do the costs vary between different firms making the same article; the costs of one article in one firm may vary according to the assumptions upon which those costs are computed. The most important of these assumptions is with regard to the volume of production; in any business having fixed charges the cost of production per unit grows steadily less as the output is increased, until a maximum or capacity output is reached. Every change in the total output for which the cost is computed will cause a change in the resulting cost per unit. In this situation it becomes necessary to assume a normal or average volume of production and usually the costs of production are computed upon that volume. It is, therefore, one of the attributes of the representative firm above referred to that it does a normal or average volume of business, upon which it earns a fair or reasonable profit. Every one of these terms is much discussed by economists; it is here only necessary to observe the fact that cost is not a fixed quantity.[1]

Similarly with selling prices: different firms sell the same or a similar article at different prices, and even the same firm will frequently sell the same article at different prices, by offering special inducements to different customers, in order to get their business. It is such conditions as these which lead people to declare that there is no relation between costs and selling prices. But these variations are much like waves on the surface of the water—they move up and down about a mean level, but that mean level is maintained. Over a period of time, selling prices find their average at a figure which will cover costs of production and will include a fair return to the producers.

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[1] For a full discussion of costs for various purposes, and under varying conditions, see *The Economics of Overhead Costs*, by J. M. Clark, University of Chicago Press.

A Survey of Opinion

The writer recently made inquiry on this point from a number of associations of manufacturers, seeking to ascertain if possible what appeared to those engaged in various lines of business to be the facts. It is realized that the opinions of association officials do not in themselves prove any relation, or lack of it, between costs and selling prices; but they were not asked for their opinions but, rather, each was asked what the facts were in his line of business, so far as he could observe. Replies were received from the secretaries of 22 associations, which included in their membership a total of some 10,700 business concerns. The principal question put to these secretaries was whether in their industry cost or market conditions seemed to be predominant in determining selling prices. The following is a summary of the replies received:

10 said prices are based equally on costs and market conditions
8 said prices are based primarily on market conditions
2 said prices are based primarily on cost
1 said prices are based on market alone
1 said prices are based on cost alone

It will be observed that, on balance, market conditions are regarded as being a more potent influence than costs in fixing prices; the difference between the two points of view is, however, less than many would expect and, in combining the whole result into a broad picture, it is clear that business men are conscious of the fact brought out by the economists that costs and market conditions, meaning demand, operate jointly to determine selling prices, and they act upon that fact. If they tend to overemphasize the influence of market conditions, that probably means only that they do not feel that they have control of the situation to so great a degree as they would wish.

Further Practical Observations

All these secretaries added a few observations to their answer to the main question, and the tendency of these remarks is significant. Practically every one of them dwelt on the fact that the stronger firms are guided more by their costs than are the weaker firms. The latter often do not know their costs; it is usually they who are responsible for selling prices which do not cover the costs of production, when such conditions exist. It was almost unanimously declared that the stronger concerns both knew their costs and acted upon them. In some lines a dominant firm sets the pace, and smaller producers come in where they can, the leader making a profit on this item and a loss on that, as with the United States Steel Corporation in the steel industry and the National Biscuit Company in the cracker industry. In other lines, such as soft drinks, uniform retail prices have been established by trade custom; competition consists not in cutting prices, but in supplying the most agreeable beverage for 10, 15, or 25 cents, respectively.

It is worth while to note a distinction between those industries where catalogue prices are established and adhered to somewhat closely for a whole season, and those industries where a jobbing business is done on orders obtained upon bids. It is in the latter case that manufacturers, working largely in the dark as to what their competitors are doing, are subjected to the most difficult forms of competition. A customer secures a quotation from one manufacturer but uses it only as an inducement to others to offer him still lower prices. When catalogue prices are printed and published, there is no positive assurance that they will not be cut in individual cases; but in general an industry is on firmer foundations when it has published quotations to serve as a standard guide to what is going on in the market. In fact this is the basis of the movement now going on under NRA codes in favor of the establishment of open or posted prices.

Estimating the Effects of Price Changes

In actual practice a company should always make careful estimates of these matters before determining their selling prices. Nearly every business is constantly faced with the question whether to maintain selling prices, and perhaps face a decline in volume of sales, or to reduce selling prices in an effort to increase the volume of sales. No action of this sort should ever be taken without first estimating the results, and these calculations will be accurate and reliable only if the accounting analysis and cost data which have been compiled are adequate and reliable.

The following table is an example of the sort of thing here referred to; in practice many more calculations would probably be made, and in much more detail, before a decision was reached. The first column of figures shows the actual results for the year 1931, and consideration is being given to the program for 1932. The most important question is what to do about the selling price, which at present is $10 per unit; should this price be cut to $9, for example, and thus perhaps make possible an increase in the number of units sold from 100,000 to 105,000? Or should we maintain the present selling price and thus face a decline in volume of 10 per cent? The table below shows the calculations:

	1931 sales, actual	1932, estimated	
		10% cut in sales prices, and 5% increase in volume	Same sales prices, and 10% decrease in volume
Sales: number of units	100,000	105,000	90,000
Value	$1,000,000	$945,000	$900,000
Cost of sales:			
Materials	300,000	315,000	270,000
Direct labor	260,000	273,000	234,000
Manufacturing overhead	200,000	205,000	198,000
Total	$ 760,000	$793,000	$702,000
Gross profit	$ 240,000	$152,000	$198,000
Selling and administrative	180,000	180,000	180,000
Net profit or loss	$ 60,000	(Loss) $ 28,000	$ 18,000

It is assumed that materials and direct labor will involve the same cost per unit under the different volumes, and that, with regard to manufacturing overhead, there is some increase when volume is increased, and some decrease in expense when volume is decreased, though the change in expense is proportionately much less than the change in volume. Under these circumstances the calculation shows that it would be much better to maintain the present selling prices and to take a reduction in volume rather than to cut prices; the latter policy would bring a substantial loss, whereas the former still yields a profit, though a reduced profit.

How Far Is Such a Computation Reliable?

If good cost records are available, then the manufacturing costs in this calculation, material, labor, and overhead should be exact; if the company has good records and a good budgeting system, it should be possible to determine the selling and administrative expense also with accuracy. The only figure remaining in doubt is, therefore, the estimate of sales. While it is impossible to estimate this with complete accuracy, yet, if the company has been in the habit of preparing estimates and budgets, it will have developed considerable skill and reliability in this respect also.

The conclusion arrived at from the foregoing calculation has considerable general significance. There is a constant tendency among business men to feel that by reducing prices they can greatly increase volume and therefore increase profits, but calculation will often demonstrate that such ideas are erroneous. As a matter of fact it requires a very considerable increase in volume to offset what seems to be a relatively small decrease in price, and it is necessary that all the figures should be carefully worked out in this way before making any decision.

Sales Research Work

The highly competitive conditions of modern business make it necessary to do more and more planning and research work in sales. It has been shown that the cost and accounting departments, if well organized, will have ready a good deal of the information required for discussing sales policies, sales programs, and selling prices; it is therefore natural that the statistical work connected with sales analysis and sales programs should be done within the accounting department, and it is in practice done there wherever the accounting department has shown itself competent to handle such work. But in some companies the accounting department staff take a narrow view of their functions and are unable or unwilling to deal with other matters than the recording of past transactions. In such cases it is natural for the sales department to set up statistical divisions of their own for supplying the kind of information, and for making the estimates and analyses, which they desire. This, however, is not good organization, and accounting departments everywhere should aim to fulfill all the functions connected with analyzing and interpreting the data which they prepare, and to supply a basis for estimates of future business.

Cost Data for Salesmen

In some industries, notably in those which sell to merchants and manufacturers, it is a growing custom to provide salesmen with data relating to the costs of the products they are selling; the salesmen are expected to use this information in support of their quotations for the goods. Obviously such a procedure would not be satisfactory where customers were unable to appreciate the significance of such information, as when goods were being sold retail to the general public. Those manufacturers, moreover, whose policy is to strive for recognition of their product on a quality basis believe that they are defeating their own object when they thus call special attention to their prices. In other words, cost information as selling talk is not a procedure which is uniformly satisfactory; yet where the customers are business men accustomed to think in terms of costs and in the habit of bargaining shrewdly, it sometimes helps a salesman if he can support his prices by reference to the costs.

One sometimes hears the assertion that it is unsound to furnish cost figures to salesmen, because they are likely to misuse them, underestimating perhaps the importance of the overhead allocations and thus yielding to the constant pressure of customers for lower prices. But for every opinion of this sort one can always hear a contrary opinion urging the value to be derived from supplying salesmen with all the facts concerning cost. Particularly if the salesmen are selling production machinery to manufacturers, in the course of which they are practically required to make estimates of the savings their customer is likely to make by the adoption of their machines, it is likely that the argument will switch from the costs of the products made on the machines to the cost of production and upkeep of the machines themselves. In such a case it is said that the salesman must be able to support his selling prices by an intelligent presentation of costs. Still another condition exists when, as is frequently the case, these machines have to be modified or adapted to special conditions or special attachments have to be added to them. A salesman who has been in the habit of handling cost figures will be able to make a rough estimate of such changes or additions, which he may in the course of discussion quote tentatively to a customer, thus improving his prospects of making the sale.

These examples will indicate that the answer to this question must depend upon the type of business and upon the type of salesmen. If the latter are accustomed to handle cost information judiciously and the circumstances seem to require it, some advantage may doubtless be gained by furnishing the information to the salesmen. Otherwise the advantage is probably in favor of not supplying such information.

Selling Expenses

The same sort of analysis that is made of the manufacturing expenses ought also to be made of the selling expenses; these expenses should be analyzed with respect to their objectives, the costs of specific selling efforts found, and the effectiveness of various men, branches, and methods ascertained with the same precision as in the manufacturing departments. As a matter of fact, such analyses have not been applied to sales nearly so widely or successfully as to manufacturing. There are various reasons for this, the chief being that it is not possible to organize selling efforts quite so definitely as manufacturing effort or to connect specific results with specific selling expenses. Nevertheless, the vast sums now being spent in selling make it necessary to do these things as well as possible, and more attention is being given to the questions of the cost of selling particular lines of goods, costs of various methods of selling, costs by district, and costs by salesman. The subject will be further discussed in Chapter XIV.

Summary

Cost of production forms the "supply price" at which goods may be offered in the market; if the market will not take all the goods at a price high enough to yield a profit to the manufacturers, the supply will tend to be curtailed. In this way costs of production, in combination with the demands of consumers, do in the long run determine selling prices.

But in practice there are so many variations in these factors that the main truth tends to become obscured; individual manufacturers find themselves so much at the mercy of surrounding conditions that they declare that they are unable in any way to control them. A closer view shows, however, that the better-managed business firms do in fact ascertain their costs, and guide themselves accordingly.

QUESTIONS AND PROBLEMS

1. State briefly what answer you would give to an assertion that selling prices have nothing to do with costs, and therefore that it is useless to gather cost information.

2. What is meant by "a representative firm" in connection with cost accounting?

3. A writer on cost accounting says, "There is no such thing as an *actual* cost of production." Do you agree? Explain what you think is intended by the statement.

4. Which items are the selling expenses in the trial balance on page 11? If it were desired to make an analysis of these selling expenses, for the purpose of finding the effectiveness of the selling effort, how do you think this analysis should proceed, and what principal information should it seek to bring out?

IV

SURVEY OF COST RECORDS

The Cost Department—Its Organization

In discussing the various types of cost work it will be helpful if the reader can visualize the department which is responsible for carrying out this work. A brief account will, therefore, here be given of the organization of the cost department and the various records which it will keep. It is, of course, possible to speak only of the typical or representative case; as will be indicated many times, there are innumerable variations in the set-up of the department and the division of work among its members. Particularly is this true of the control of the department as a whole and its relation to other departments and also of the relationship between the cost records and the general accounting records.

Typically a chief cost accountant, or works auditor, will be in charge of the department. Under him will be a staff charged with keeping the cost accounting records proper, the payroll records, the perpetual inventory records, and the preparation of reports. If the plant is large enough, each of these subsections will have a chief responsible to the chief cost accountant. The nature and variety of the clerical work will be analyzed especially with a view to determining the amount of repetitive work, and upon this analysis a proper equipment of adding machines, bookkeeping machines, and perhaps tabulating machines will be secured for the joint purpose of saving labor and of preparing statistical analyses which might otherwise be practically impossible, because they were expensive to do by hand.

Control of the Cost Department

It is next necessary to determine to whom the chief accountant himself shall be responsible. In practice this is often made to depend upon the manner in which the department was originated, but consideration will show certain necessary conditions to be observed. A successful cost department will satisfy three conditions:

1. It will be tied in with the general accounting to guarantee the accuracy of its fundamental figures.
2. It will supply reports which will represent fair analyses of these original figures and will serve as constructive criticism upon all operations coming within its scope.
3. Its reports will afford guidance to the manufacturing heads as to the efficiency of their operations.

There are accordingly several different interests to be served and it is this circumstance which gives rise to the conflict of opinion as to who should control the cost department. The dispute usually reduces itself to two alternatives, namely, either to place the comptroller in charge or to allocate that function to the production manager. If there is no comptroller, and the supervision of all records is in the hands of a treasurer, he, of course, would be substituted for the comptroller for this purpose. The arguments in favor of making the chief cost accountant responsible to the comptroller are the necessity for the tie-in between the cost records and the general accounting records, the necessity for getting from the cost department accurate inventories to go into the balance sheet, and the necessity for obtaining independent and unbiased reports upon the manufacturing operations. It is argued that a production man, not being primarily interested in these things or being likely to be prejudiced in any reports concerning his own administration, is not the most suitable person to control the cost department. On the other hand, it is contended that, if the main function of the cost department is to supply analytical reports on the manufacturing operations, the cost department must be as close as possible to the manufacturing departments, must learn what their problems are, must speak their language, and must in every way work with them.

Comptroller to Decide on Methods

In practice it is usually found that the former considerations are the more important, and that it is advisable to place the cost work under the jurisdiction of the comptroller; as a modification of this it may sometimes be advisable to place some of the members of the cost department staff under the production manager for purposes of general discipline. But the form or content of reports, and the methods by which they shall be prepared, will usually be at the discretion of the comptroller. This, however, does not mean that any of the other functions of the cost department should be excluded; with a reasonable spirit of cooperation it will be found possible to supply the needs of all parties interested in the cost records, and the cost department should make it a duty to familiarize itself with the technical problems of the works in order that the cost reports may be made as useful as possible.

Cost Items Classified

Form 2 shows a listing of the principal items of cost for the ordinary manufactured product, arranged into their usual groups. The forms and methods by which these costs are recorded and gathered will be shown in the subsequent chapters of this book; here it is intended to present only a summary table of the items, in a form to show how they are related.

Total cost includes the manufacturing costs, the selling costs, and the administrative costs. Sometimes these are reduced to two groups by apportioning the administrative costs between the manufacturing and selling; then all the expenses of the company are stated as costs to make and sell the product. The manufacturing cost in turn is divided into three main parts: the direct materials entering into the product, the direct labor put into it, and the general expenses which include everything else and are commonly called burden or overhead. When profit is added to total cost, the selling price is found. In some ways it is more true to say that, when the total cost is subtracted from the selling price, the net profit is found; because unfortunately it is usually necessary, in setting a selling price, to take many things into consideration besides costs.

Form 2 may be regarded as referring to the total business of the company, in which case it is practically a skeleton form of income statement; or it can be looked at as a cost summary for a single manufactured product. In other words, in every product of a company there will normally be included a proper share of every item of cost in the company's income statement. It is one of the main purposes of cost accounting to discover how much of each item of total cost should be charged to the various kinds of products made.

- Selling price
  - Total cost
    - Factory cost
      - Direct materials
      - Direct labor
      - Manufacturing burden
        - Depreciation
        - Taxes
        - Insurance
        - Interest
        - Indirect materials
        - Supplies, mechanical
        - Supplies, general
        - Superintendence
        - Supervision
        - Inspection
        - Indirect labor
        - Factory clerical
        - Designing
        - Drafting
        - Heat
        - Light
        - Power
        - Spoilage
        - Freight in
        - Trucking, inside
    - Selling expense
      - Salesmen's salaries
      - Salesmen's expenses
      - Salesmen's commissions
      - Salesmen's automobile expense
      - Advertising
      - Sales development expense
      - Samples
      - Freight out
      - Finished stock handling and storage
      - Boxes and containers
      - Sales office salaries, administrative
      - Sales office salaries, clerical
      - Sales office stationery and supplies
      - Sales office rent
      - Sales office telegraph and telephone
      - Discounts and allowances
    - Administrative expense
      - Officers' salaries
      - Office salaries, accounting
      - Office salaries, other
      - Printing and stationery
      - Telephone and telegraph
      - Postage
      - General office expense
      - Auditing expense
      - Legal expense
      - Life insurance on officers
  - Profit

Form 2: General chart of costs.

The Cost Ledger and Its Control

If the plant is relatively small or its operations are not very varied, it may be found desirable to make the cost records consist of a series of reports controlled by two or three accounts kept in the general ledger, without having a separate cost ledger. Whenever a plant becomes larger, however, or shows considerable variety of expense items, or different operations or products, it will usually be found desirable to use a separate cost or manufacturing expense ledger, controlled by one or several accounts in the general ledger. This is another place where a great variety of practice is found, in adapting methods to the conditions of the particular case. In the cost ledger the primary expense accounts may be kept to avoid having too many accounts in the general ledger, or the primary expense accounts may be kept in the general ledger, and the cost ledger will then contain the secondary accounts, such as departmental accounts or functional or process accounts to which the primary expenses have been distributed. This division of work between the cost ledger and the general ledger will be largely a matter of convenience in the individual case, having regard to the degree of detail and the amount of work involved in the various parts of the work and also to the question of the allocation of work among the various members of the staff, and the methods of compiling reports at the end of the month.

Varieties of Ledger Control

There is a similar freedom in the precise form or mechanism which shall be followed in the use of accounts in the general ledger to control the cost ledger. Probably the most common practice is to have a single control account in the general ledger entitled Cost Ledger, Manufacturing Ledger, or Work in Process. It is, however, often found desirable to subdivide this account, for example, into Material Control, Labor Control, and Manufacturing Expense Control. Still another method is to have control by departments in the general ledger, with the detailed accounts for the departments in the cost ledger. This may be very desirable when the separate departments are large and it is desired to pay special attention to each of them.

Books of Original Entry

Whatever form of general ledger control of the cost ledger is devised, the method of operating this control will follow the usual lines; that is to say, columns will be provided in the books of original entry with headings corresponding to the control accounts; the totals of these columns will be posted to the control accounts, and the detailed items to the subsidiary accounts in the cost ledger.

The principal book of original entry will ordinarily be the voucher register, through which most of the manufacturing expenditures will pass. In fact it is desirable to use this to cover as many of the manufacturing expense items as possible. There will, however, normally be sundry items to be picked up from the cashbook and from the petty cashbook; if material purchases are not passed through the voucher register, they must, of course, be recorded in a purchases journal. In addition to the general journal it is often convenient to have a cost journal for various adjustments and the closing entries of the cost ledger. The clerk responsible for the cost ledger will arrange a regular schedule of postings in order to be sure each month that he posts all the records in which entries affecting his ledger have been made.

Perpetual Inventory Records

It is the common practice for a perpetual inventory, when kept, to be regarded as part of the regular work of the cost department; this is especially true when the perpetual inventory is kept in terms of money value as well as in quantities, and those values are used for costing materials issued to process. A perpetual inventory is a detailed record, often in card index form, for keeping account of goods held by a manufacturing or merchandising company; it commonly includes an account for each kind of goods, so as to give a control by items as well as in the aggregate. When, as sometimes occurs, the perpetual inventory is kept in quantities only and its principal object is considered to be the control of inventory quantities, it will occasionally be found in the stores department office; this, of course, presupposes that there is in that office clerical help adequate for the keeping of the perpetual inventory. It is because it is often desired to avoid keeping a considerable clerical staff in the stores department that the record will usually be kept in the cost department.

Payroll Preparation

In the chapters relating to payroll and labor costs the double aspect of the records connected with these expenses is emphasized; the payroll must first be prepared, in order that employees may be properly paid on due date, and then be analyzed and distributed for the purpose of finding proper costs. A section of the cost department will be devoted to this purpose.

Relation of Cost to Planning Department

The conflict about authority over the cost department has sometimes been reflected in the relations between the cost department and the planning department; the production executives have in some cases contended that the planning department is solely a production mechanism for the planning and scheduling of work and have accordingly separated the two departments and treated them as distinct functions. But while it is true that these two departments have different purposes in mind, yet these different purposes can be accomplished largely by the same agency, and each will be assisted by contact with the other. The forms used for purposes of ordering and scheduling work can, with slight modification, be also used for gathering cost data; the production order itself, for example, may often with advantage have spaces provided on the reverse side for assembling the costs of material, labor and burden chargeable to it. The best results undoubtedly are obtained by friendly cooperation between these two departments; often they are housed in the same or adjoining rooms; and firms which have made a separation between them have found it a disadvantage and have tried to combine the two as much as possible.

Estimating for Bids

In a plant which secures much of its business in the form of orders obtained as a result of competitive bidding, an estimating department is required which can supply the sales department with the figures necessary for making such bids.

For its material costs this department will naturally keep in close touch with the movements of current market prices. These, or expected prices, are likely to be the principal consideration in determining the prices at which materials shall go into the estimates. For labor and burden it will be necessary for the estimating department to obtain unit figures, such as hourly rates and the number of hours required to perform certain operations, from the cost department. Here again, therefore, there is need for close cooperation. Although the purposes of the two functions are somewhat different, a good deal of interchange of information is necessary.

The Cost Sheets

In the course of keeping material costs, the perpetual inventory records, and the payroll records, the cost department will have to provide for obtaining the details of all material and labor used for different jobs or departments. This information will be summarized according to the fundamental cost method in use, and cost sheets will be prepared to assemble manufacturing costs either by the job or by the period, as discussed in Chapter XV. When burden has been added at the appropriate rates, the cost sheets will represent a complete summary of the manufacturing costs of the product covered. In the case of job costs there will have to be some mechanism for summarizing all costs on all the jobs completed within one month; where process costs are used, this will be the information contained in the cost sheets in the first instance. In some respects much of the work of the cost department centers around the preparation of these cost sheets.

Work in Process Inventories

Reference has been made earlier in this chapter to the provision of proper expense accounts in the ledgers and to the transfer of such expenses to departmental or process accounts. One of the most important results of this procedure is the building up of accounts representing the cost value of work in process inventories. It is one of the most important duties of the cost department to keep these inventory accounts accurately, since they will be used in the preparation of the monthly balance sheets; and, if they have been well kept, but slight adjustment will be necessary to make them available for the annual balance sheet. After all the costs for material, labor, and burden have been brought into the work in process accounts, moreover, it is then necessary to make transfers from these accounts to the Finished Goods account to record the values of goods completed during the period and either stored in warehouses or shipped to customers. Any questions of cost procedure which are under discussion must, therefore, always be considered, among other things, in their relation to their effect upon these inventory values.

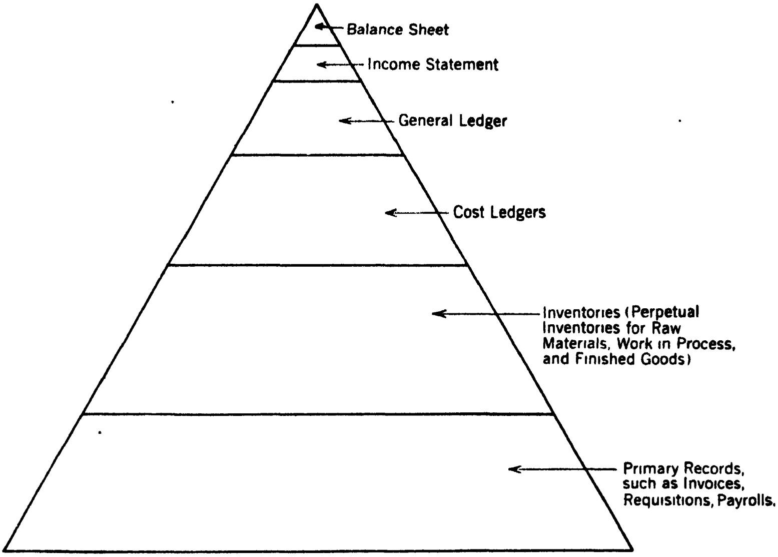
Cost Reports

In addition to the regular cost sheets for jobs or processes, the cost department will have to prepare a number of accounting and statistical analyses to fill the needs of all executives who are interested in cost information. These reports will be further discussed in Chapter XX of this book; it is here only necessary to say that they are the aim and end of almost the entire work of the cost department; unless its detailed routine records can be accurately summarized and effectively analyzed to indicate important facts and conditions for the management to take note of, the routine work of the cost department is in large part wasted.

It is hoped that this survey of the various operations performed by the cost department will enable the student to consider the problems dealt with in succeeding chapters with a clear appreciation of the various aspects involved. In particular it is necessary for him to realize, in discussing any problem, precisely at what point in the procedure the problem arises, and for what purpose its results are desired. In the case of burden distribution, for example, it is necessary to see clearly that a preliminary or estimated distribution may be made at the beginning of the period for the purpose of computing burden rates afterwards to be charged to jobs. At the end of the period another distribution may be made to check the actual expenses of the period with those estimated in advance and to help in the consideration of the question whether to change the burden rates in coming periods. The burden distribution sheet is often a rather complicated matter and is primarily one of the cost accountant's detailed computations. The cost sheet is not, therefore, always suitable for presentation to executives as a report for advising them of actual expenses; such information may often be presented in more direct and simple form.

Diagram of Accounting System

The general picture presented in this chapter may be illustrated roughly by the figure shown below:


Balance Sheet
Income Statement
General Ledger
Cost Ledgers
Inventories (Perpetual Inventories for Raw Materials, Work in Process, and Finished Goods)
Primary Records, such as Invoices, Requisitions, Payrolls.

The entire triangle represents a complete system of accounting records. At the top are the summaries, in small compass, by which the management controls the entire business. Below in succession are the various records from which the summary statements are drawn, and upon which they are based. Toward the bottom the volume of records increases very greatly, much more so in fact than is indicated in the illustration. At the top is the balance sheet; on a single sheet of paper a picture of the entire business is contained. Next is the operating statement; this really is a detailed enlargement of one part of the balance sheet, namely, the addition made to the surplus during the year. Below that is the general ledger, the books of accounts from which both the balance sheet and income statement are derived. Next come the cost ledgers, which are enlargements of certain accounts in the general ledger, namely, the inventory accounts or work in process accounts, or factory ledger accounts, whichever they may be called. Still further down are the inventory records, including the perpetual inventories for raw materials, the cost sheets for work in process, and the detailed inventory records for finished goods. Finally, at the bottom are the primary records, the original papers which evidence all transactions. These include such things as purchase invoices, sales invoices, requisitions of raw materials for manufacture, labor tickets for individual workmen, and so on. From these records entries are made in the inventories and in the ledgers.

Thus in the foregoing figure the general movement of information through the records is from the bottom upward. A complete and thorough system of accounting control means that all information entering at the bottom works itself up, by orderly processes and records, until it comes out in a correct balance sheet and income statement at the top. Any faults or weaknesses in the accounting system will automatically result in the balance sheet and income statement being incorrect. Only one other feature of a good accounting system need be mentioned here, namely, that this upward movement and summarizing of information shall be done as economically as possible, that is, with the least expenditure of clerical labor and in the shortest possible time. This results not only in economy but also in prompt statements to the executives.

QUESTIONS AND PROBLEMS

1. In your opinion which official of a manufacturing company should have control of the cost department, and why?

2. By what records may the cost department keep account in detail of the raw materials held for manufacturing purposes? What would such a record show, and what would be its advantages?

3. What are the principal duties of the cost department with regard to labor records?

4. Under what circumstances would you expect to find a separate cost ledger in use? What would be its connection with the general ledger? Would this connection always be the same? Explain your last answer.

5. The trial balance of the Jefferson Mills on January 1, 1929, was as follows:

Cash	$ 60,000
Accounts Receivable	95,000
Inventory, Raw Cotton	20,000
Card Room Work in Process	12,000
Spinning Room Work in Process	10,000
Spooling Work in Process	15,000
Weaving Work in Process	13,000
Finished Goods	30,000

Plant and Machinery	500,000	
Accounts Payable		$ 45,000
Capital Stock		600,000
Surplus		110,000
Sales		
Cost of Goods Sold		
Payroll, Direct Labor		
Manufacturing Expenses		
Selling Expenses		
Administrative Expenses		
	$755,000	$755,000

During the month of January cotton purchases amounted to $130,000, and sales of cloth to $180,000, all on account. Cost of goods sold was $136,000; the payroll for the month was $26,200, of which $14,000 was for the card room; $6,000 for the spinning room; $5,000 for spooling, winding, and beaming; and $1,200 for weaving.

Total manufacturing expenses for the month, all paid in cash, were $3,400, divided as follows:

Card Room	$1,500
Spinning Room	1,000
Spooling, Winding, and Beaming	500
Weaving Production	400
	$3,400

At various stages of the manufacturing operations, waste was sold for cash as follows:

Bagging and Ties, from Opening Room (Raw Cotton)	$ 400
Card Room Waste	18,100
Spinning Room Waste	300
Spooling and Winding Waste	200
	$19,000

Other transactions included: cash received on account, $177,000; cash paid on account, $135,000.

Selling expenses, $21,500; administrative expenses, $12,000; all paid in cash.

The inventories in process on January 31 were:

Cotton in Warehouse	$24,000
Card Room Work in Process	15,000
Spinning Work in Process	8,700
Spooling Work in Process	12,000
Weaving	16,500
	$76,200

a. Open a ledger, with balances as in the foregoing trial balance, and post the foregoing information for January, 1929.

b. Take a trial balance as of January 31, 1929.

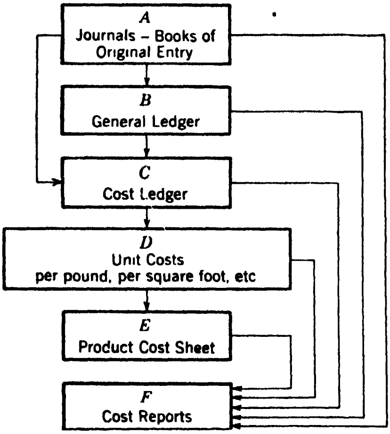
c. Prepare a summary of manufacturing operations for January.

V

HEATON STOVE COMPANY

A Practice Illustration

In the last chapter was given a general description of the records which make up a cost control system. There will now be shown an example which will illustrate much of what has been said. Especially there is presented a series of cost ledger accounts with the control or balancing account, together with the relation between these accounts and the calculation of unit costs, from which the total cost of a specific type of product is in turn computed. After the descriptive statements there follows a practice exercise covering the points discussed; this exercise starts with the total transactions for the period, after which the student proceeds to close the accounts. It is in closing that we see how the final costs are obtained by transferring and combining the various items. The chapter therefore includes detailed instructions at every step, so that the student can understand clearly what he is required to do. This will enable him in a short time to grasp more about the essentials of cost accounting than any purely descriptive paragraphs can give him. But first the student will be assisted by the accompanying diagram showing the main outlines of a cost system, the way in which the different records relate together, and the particular parts of it dealt with in this chapter.



In the foregoing diagram Items *A* and *B* constitute the main records of the regular financial accounts. Item *C*, the cost ledger, is subsidiary to Item *B* but is posted direct from the books of original entry, principally from the voucher register. From the information gathered in the cost ledger it is possible to compute Item *D*, the costs per unit of the various types of production work done, and from these is figured the total cost of a completed article ready for sale (Item *E*). This chapter is concerned with Items *C*, *D*, and *E*. By various combinations of the first five groups the cost reports, Item *F*, are obtained, to give whatever information the managers would like to have from the records.

One warning of a practical nature ought to be given. The cost records here shown are in actual business not always kept in the form of ledger accounts in a cost ledger, though they often are. There is a great variety in the forms and manner in which the information is collected, but in substance all the steps shown here have to be taken in some way. The form is largely a matter of convenience and of the preferences of the men running the particular business.

Manufacturing Processes

The Heaton Stove Company makes stoves and cooking ranges. Manufacturing operations of the company are divided into two main divisions: (1) castings, which include hand-molded and machine-molded castings; either of these may be machined before being put into castings stores; and (2) all other operations, which are here for brevity called assembling operations, though they include such auxiliary processes as tinning, nickeling, machining, and so forth. Further details of the plant organization are indicated in the list of accounts given below and in the notes attached to them. It is important to note the way in which the accounting procedure runs parallel with the manufacturing operations.

List of Cost Ledger Accounts

The complete list of accounts in the cost ledger is as follows:

Account Number	Account Name
1	Castings, Piece Wages
2	Castings, Casting Machine Costs
3	Castings, Machining Costs
4	Castings, Indirect Costs
5	Castings, Total Costs
6	Finished Castings Stores
7	Mounting Stock (finished castings issued for assembling)

Account Number	Account Name
8	Tin Shop
9	Nickel Shop
10	Equipment (tinned sheet metal, nickeled parts, bolts, nuts, mica, etc.)
11	Assembling Indirect Expense
12	Assembling Direct Expense
13	Assembling Total
14	Space Costs
15	Power Costs
16	Machine Costs
17	Bathroom Costs
18	Machine Shop
19	Maintenance
20	Designs
21	Patterns
22	Factory Administrative Costs
23	Finished Stoves Stores
24	Cost of Parts Sold
25	Cost of Stoves Sold
26	General Ledger Control (credit with total expenses)

Grouping of the Accounts

It will be seen that the cost ledger accounts group themselves into main divisions which correspond with the manufacturing organization.

The first seven all relate to castings: Accounts 1 to 4 contain the various items in the costs of castings; Account 5 brings them together in a total; Account 6 is an inventory account showing castings put into and out of stores; and Account 7 records as debits the castings issued from stores for the purpose of being assembled into stoves.

Accounts 8, 9, and 10 are for various small parts entering into the assembly of the stove, all materials, in fact, other than castings.

Accounts 11 to 13 inclusive contain the other main manufacturing costs, those relating to assembling or putting the stoves together; these costs are brought to a total in Account 13.

When these accounts have been duly posted, Accounts 7 and 13 will contain all the costs; the former will contain all the costs of castings, and the latter all other costs. They are therefore brought together, in the closing, in Account 23, Finished Stoves Stores, representing the total cost of stoves manufactured and put into the storeroom.

Many indirect expenses have entered into these costs, although they were first recorded in another series of accounts, numbered 14 to 22, inclusive. These include the costs of the space used for manufacturing purposes, power costs, maintenance, designs and patterns, and factory administrative costs. The charges to these accounts are entered as they arise and are then closed out, that is, redistributed, to the departments or operations which they serve. Precise instructions for this closing are given later, after the list of transactions.

Then follow two accounts for cost of goods sold, the first being the Cost of Parts Sold, and the second Cost of Complete Stoves Sold.

Finally comes an account entitled General Ledger Control; in the cost ledger it is a balancing account. It is credited with all the expenses charged to the various cost accounts and is debited for any adjustments made for the purpose of reducing these costs. It will also be debited with the balances of the two cost of goods sold accounts when they are closed at the end of the period. It corresponds to the account in the general ledger which controls the cost ledger, except that the entries are reversed. That is, in the general ledger all costs are debited to the Cost Ledger Control account, whereas in the cost ledger they are credited to the General Ledger Control account. On the other hand, all work completed is credited to the Cost Ledger Control account in the general ledger; but in the cost ledger the General Ledger Control account is debited. In this way both the general ledger and the cost ledger are made self-balancing.

Costs for March, 1933

The following figures show the net costs properly chargeable to March production. Enter them to the debit of the accounts indicated, crediting Account 26 for the total.

Item	Amount	Charge to account
Materials	$13,800	4
Supplies:		
Coke, oil, sand, etc	2,600	4
Coal, wood, etc	1,600	15
Lumber	108	21
Nickel and chemicals	250	9
Sheet iron	100	8
Stationery	100	22
Bolts, nuts, rods, etc	300	10
Design supplies	75	20
Janitors' supplies	30	14
Engineering supplies	75	15

Item	Amount	Charge to account
Manufacturing labor:		
Stock shed, cupola, cleaning, sorting, and racking	5,500	4
Engine and boiler room	1,705	15
Molding and casting, piece wages	15,000	1
Machine wages	2,000	2
Fitting, mounting, blacking, packing	4,200	12
Tin shop	750	8
Nickel shop	1,200	9
Warehouse	1,500	11
Working offices	5,440	22
Watchmen and janitors	1,300	14
Machine shop	1,200	18
Designing, blue prints, etc	2,500	20
Pattern making	1,400	21
General expenses:		
Rent, maintenance of buildings and grounds, water, etc	3,490	14
Maintenance, power plant $660		15
Machines 560		16
Foundry 850		4
Miscellaneous 21		11
Total maintenance	2,091	
Interest, taxes, insurance, 8% on valuations		

Total of all foregoing costs, $69,610, including $1,296 for interest, taxes, and insurance, which should be charged according to the following table of valuations:

Valuations	Value	Charge 8 per cent to account
Foundry department	$ 1,400	4
Power department	4,500	15
Heating and lighting	2,000	14
Machine costs	1,500	16
Bathroom	200	17
Casting machine	400	2
Machine shop	800	18
Pattern shop and patterns	3,950	21
Assembling department	650	11
Designing department	300	19
Administration	500	22
	$16,200	

Order of Closing

The problem is now to close the accounts. The order of closing them follows the course of the actual flow of work through the shops as closely as possible. Expenses which apply to the same department or process are gathered together; and when work is transferred from one department to another, the costs of that work are transferred into accounts to correspond. Since several departments make charges to each other, it is necessary to work out the most practical order of closing the accounts, in order to avoid going round in circles. In some cases the entire balance of an account is transferred in one sum to the next account, as when the various divisions of castings costs are transferred to Castings, Total Costs. In other cases the total balance of an account is distributed to several accounts, such as when the Space Costs are divided among the various departments which occupy the space. Thus the cost department worked out the following order of closing the accounts, as being best for its purposes.

How to Distribute the Indirect Charges

First those accounts which have to be distributed among several other accounts are closed, thus:

Power Distribution (Account 15):

15% to Account 14; 85% to Account 16. This means that Account 15 is to be credited with its total, and the other accounts debited with the portions indicated

Space Cost Distribution (Account 14):

To Account 4	25%
To Account 11	30
To Account 17	10
To Account 20	10
To Account 21	10
To Account 18	10
To Account 22	5

Machine Costs (Account 16):

$^{4}/_{17}$ to Account 2; $^{4}/_{17}$ to Account 4; $^{7}/_{17}$ to Account 18; $^{2}/_{17}$ to Account 21

Machine Shop (Account 18):

To Account 12, $229; Account 3, $2,800; the balance is already included in the foregoing figures for maintenance. This balance should therefore be debited back to General Ledger Control, as being a duplication

Designs (Account 20) close to Factory Administrative Costs (Account 22):

Are distributed, $^{1}/_{5}$ to Assembling Indirect (Account 11) and $^{4}/_{5}$ to Castings Indirect (Account 4)

Instructions for Closing the Remaining Accounts

The accounts may then be closed as follows:

Account number	Account name	Close into account
17	Bathroom Costs	4
21	Patterns	4
1	Castings, Piece Wages	5
2	Casting Machine Costs	5
3	Machining Costs	5
4	Indirect Costs	5
5	Total Costs	6
6	Finished Castings Stores	
	To Mounting Stock $48,800	7
	Cost of Parts Sold $2,055	24
	Balance is inventory	
7	Mounting Stock	
	To Finished Stoves Stores $46,000	23
	Balance is inventory	
8	Tin Shop	10
9	Nickel Shop	10
10	Equipment	12
11	Assembling Indirect Expense	13
12	Assembling Direct Expense	13
13	Assembling Total	
	To Finished Stoves Stores $11,300	23
	Balance is inventory	
	Accounts 14, 15, 16, 18, and 22 are already closed by distribution of the charges, as previously described	
23	Finished Stoves Stores	
	To Cost of Stoves Sold $51,800	25
	Balance is inventory	

This completes the closing; take a trial balance to check the work.

Unit Costs

Find the cost of production per pound for the different types of materials and the cost of nickeling per square inch, using the following:

Production:	
Total castings made	1,660,000
Machine-molded castings	200,000
Hand-molded castings	1,460,000
Machined castings	280,000
Tinned sheet iron used	25,000
Nickeled surfaces	145,000 sq. in.

The direct costs of machine-molded castings are shown in Account 2.

The labor costs of hand-molded castings are shown in Account 1.

The direct costs of machining castings are shown in Account 3.

The indirect cost of castings (Account 4) is allocated to the several products, namely, machine molding, hand molding, and machining of castings, in proportion to their direct costs. (Figures to the nearest dollar will be satisfactory.)

These calculations are made entirely outside the accounts. The first step is to add the indirect costs (Account 4) to the direct costs of various types of castings (Accounts 1, 2, and 3) as indicated in the last paragraph. Then the total production of each class of product is divided into the respective total costs. The same thing is done with the tin shop and nickel shop, as recorded in Accounts 8 and 9.

Cost of a Specific Model

The unit costs, as found above, are used in computing model costs; for this purpose, figures of the nearest tenth of a cent above the exact unit cost are selected. Using such figures, show the cost of Model 84, which has the following specification:

INFORMATION FOR MODEL 84

Castings used: total, 300 lb. of which 60 lb. were machine-molded and 240 lb. hand-molded; 40 lb. were machined
Tinned sheet iron used, 20 lb.
Nickeled surface used, 135 sq. in.
Bolts, nuts, rods, etc., 43¢
Mounting labor, 97¢

Review of the Exercise

The student should not be confused by the processes of stating the cost gathering processes in the form of ledger accounts; what he has now done is to record some simple facts. First, the actual costs were charged to the various accounts opened to receive them; some of these accounts had to be combined together to get interesting totals, such as the total cost of all castings, the total cost of assembling them, or the total cost of doing various types of work. Step by step these costs were carried along until the cost of the finished stoves manufactured and ready for sale was obtained, from which the cost of stoves actually sold was derived.

Then, outside the accounts proper, but using the information in them, other interesting facts were computed. By dividing the quantity of the production of different types of work into the total costs of doing that work, as shown in the accounts, the costs per pound, per square foot, and so on, for different parts of the stoves were found. Then, to find the cost of any particular stove model, it was a simple matter to multiply these unit costs by the number of pounds, etc., of the various parts and materials that were used on that model.

PART II

THE ELEMENTS OF COSTS

VI

MATERIALS—PURCHASING AND USING THEM

Materials—Direct and Indirect

The first item of cost in the production of any article is usually for the raw materials out of which that article is fashioned or converted. It is therefore necessary for the cost accountant to be familiar with the procedure for purchasing such materials, as well as for receiving and inspecting them, issuing them to the manufacturing departments, keeping track of them until finished, and costing for them.

The term "materials" here includes all those materials which enter directly into the manufacture of the product so that they can be plainly identified with it; such materials can be treated as a direct cost of the product, and the amount chargeable to the product for them is easily ascertainable. Materials which are used in small quantities only, so that the precise quantity used in any one article would be somewhat difficult to measure, are often not regarded as direct material costs, because the computation of the amount of cost would be more trouble than it is worth. In making a desk, for example, the lumber used in it and the principal metal fittings would be treated as direct materials, the costs of which would be charged as separate items to the desk; but varnish and polishes would be treated as indirect materials and included with the overhead expense. The dividing line between direct materials and indirect materials which are to be included in the overhead is not always easy to define, but in any particular case a common-sense division is all that is necessary. In printing, for example, if the job is of considerable magnitude, requiring a special supply of ink, then a separate charge for ink might be made to the job under the head of direct materials. But if the job is a small one which can be run off with the ink already on the rollers, no special charge would be made for this ink; it would be included in the general overhead. Similarly, all supplies used in the manufacturing processes but not actually entering into the product are also treated as overhead expenses.

Obtaining Materials—The Purchasing Agent

The work of obtaining raw materials and supplies of the right kind and at the right price is of importance in every manufacturing business. It requires knowledge in two directions; the man entrusted with this duty must be familiar with the internal conditions of the business and with its precise requirements, and he must also be acquainted with external conditions, with the general character of the market, and with detailed information as to the most advantageous places and modes of purchasing. Of these two classes of information it is probable that the latter is much the more difficult to obtain; it is not as a rule a difficult matter to have the manufacturing departments furnish a purchasing agent with precise specifications, but it is more of a task to have this purchasing agent fill these specifications to the best possible advantage. For this reason, most manufacturing businesses of any size set up a central purchasing department which is entrusted with this special function. Departmental managers are usually fully engaged with the internal administration of their departments and do not have time to master the details of outside markets. It is well understood, however, that in small plants, or in a factory where the requirements are simple, such a special department will not be necessary, and departmental heads may be able to order their own materials. Even then, however, some sort of general control over purchasing is necessary to avoid overstocking and to keep managers within the budgeted program.

Who Initiates Purchases

Assuming that there is a purchasing agent entrusted with the duty of making all purchases, what should be the procedure? In particular, how should purchases originate? There are three methods found in practice, any one or more of which may be suitable in a given case. First, a careful control of stores, as described in the following chapter, may furnish information as to when further materials should be ordered; second, departmental managers may have authority to make requisition upon the purchasing agent for their needs; third, the purchasing agent may himself have authority to initiate purchases.

For the first method it is clear that well-organized central stores are necessary, through which all materials have to pass, and that adequate control records be kept of all movement of goods into and out of these stores. Where this is possible without too much clerical labor and other expense, it is without doubt the most satisfactory and desirable method. Where this is not possible, however, it may be necessary to allow departmental heads to make requisition upon the purchasing agent for materials which they need. This will be particularly the case where there is no central storeroom, materials being delivered direct to manufacturing departments. Such a situation does not always mean that there is no control of stores; on the contrary, departmental records are sometimes kept to provide each foreman with a perpetual inventory of stores under his control. Without these records, there is likely to be that irregularity in stores control which it is the purpose of all stores systems to avoid; goods wanted will be out of stock, and other materials will be in excessive supply.

There are also cases where departmental stores are kept and controlled by corresponding departmental inventories, where the purchasing agent keeps a parallel set of records on the basis of which he is able to order without any preliminary requisitions from the departments. This leads to the third situation, in which the purchasing agent is left to his own discretion as to when and in what quantities to purchase, this being particularly desirable when price fluctuations are a factor. The purchasing agent, advised by a statistical department if the firm is large enough to have one, is in the best position to judge when prices are favorable for making purchases.

The question whether the purchasing agent shall be allowed discretion to buy when he deems the conditions favorable cannot be answered on a theoretical basis alone; it will necessarily involve a consideration of the particular purchasing agent. If he is a man of ability and judgment, he will naturally be accorded much more freedom of action than another agent who does not show these qualities. A study of the actual conditions of business indicates that personal considerations of this sort determine organization matters in at least as high degree as any other circumstances. In the great majority of cases the safer policy is to have the purchasing of materials carefully regulated to the manufacturing needs of the business. If the purchasing agent is to speculate in raw materials, as is done when he buys more than is immediately necessary, two safeguards should be put on the situation: first, it should be determined by special vote of the directors; and, second, such excess purchases should be separately accounted for, in order to show the results of the policy.

The Purchase Requisition

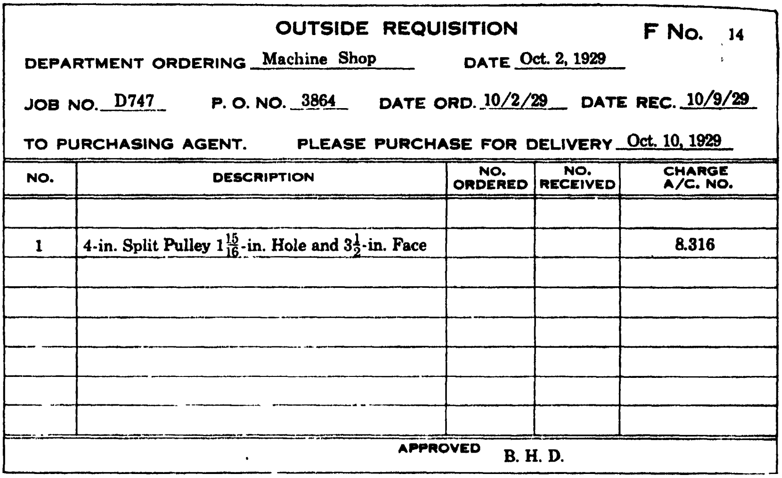
When the question of who shall have authority to initiate orders has been settled, the requisition itself is merely a matter of stating precisely what is required. Form 3 is an illustration of a purchase requisition. The original requisition should indicate what account number or symbol is to be charged for the goods in question; if this symbol is then transcribed on the purchase order itself, it will aid in making a proper distribution of the charge when the invoice is received.

In Form 3 a space is provided at the top for the specific job number to be charged with the costs of these materials, and the last column is to contain the ledger account number to be charged. Putting these account numbers on the original requisition, and copying from there to the purchase order, saves a good deal of trouble later on. Moreover, it is an additional precaution against purchasing unnecessary materials and supplies, since this designation of a specific account to be charged always raises the question what the materials are for, and whether they are really necessary.

This requisition will, as indicated in the preceding paragraphs, be made out by a stores clerk in charge of inventory records or by a shop clerk who has found the materials to be necessary for a specific job. At the bottom of the requisition a space is provided for the approval by a departmental manager or foreman, thus providing further safeguard against unnecessary purchasing. This matter cannot be too greatly emphasized; even in times of bad business some companies have been known seriously to injure their financial condition by piling up unnecessarily large inventories, just because it had become the practice for almost everybody on the staff to order materials without restriction.

The Purchase Order

From this requisition a purchase order will be prepared in the purchasing department, addressed to a proper vendor. On this purchase order will be entered all the necessary information from the purchase requisition, including description of the goods and accounts to be charged. A form of purchase order is shown in Form 4, which has been prepared in accordance with the purchase requisition shown in Form 3. A copy of the purchase order goes to the receiving department. It is sometimes suggested that the omission of the quantity ordered from the advice to the receiving department will necessitate a careful independent count of the goods actually received there; this count might be checked against the purchase order. The other view is that the receiving department should be fully advised what to expect and should be entrusted with the duty of making the check against the purchase order. Among firms who have tried both methods it seems to be the consensus of opinion that the best results are obtained when the receiving department is notified of the quantity ordered, the great advantage being that this department can thus observe immediately whether anything is wrong with the goods received and can apply for instructions at once. If, on the other hand, the receiving department must make its report to another depart-



OUTSIDE REQUISITION F No. 14

DEPARTMENT ORDERING Machine Shop DATE Oct. 2, 1929

JOB NO. D747 P. O. NO. 3864 DATE ORD. 10/2/29 DATE REC. 10/9/29

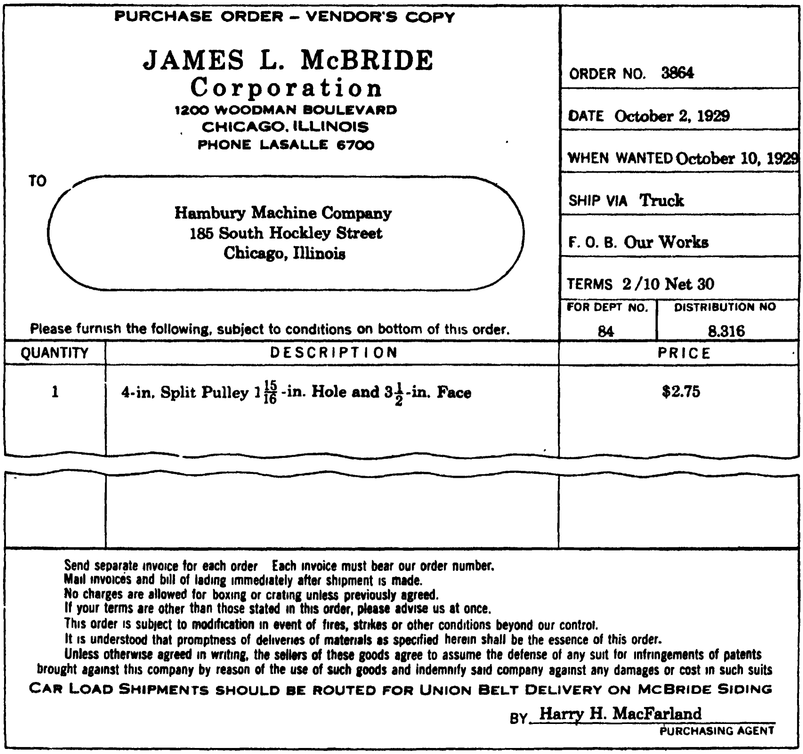
TO PURCHASING AGENT. PLEASE PURCHASE FOR DELIVERY Oct. 10, 1929

NO.	DESCRIPTION	NO. ORDERED	NO. RECEIVED	CHARGE A/C. NO.
1	4-in. Split Pulley $1\frac{15}{16}$-in. Hole and $3\frac{1}{2}$-in. Face			8.316

APPROVED B. H. D.

Form 3: Purchase requisition.

ment and then await instructions as to whether or not the goods are as ordered, the goods in the meantime must lie around in the receiving stores. Delay and confusion are thus caused which it is desirable to avoid. In any case, a receiving department of any size will provide a check because there will be a head clerk, supervising a force of helpers. The head clerk will have the duplicate purchase order, and the helpers will actually open and inspect the goods, making their report to him as to the quantity and character of the goods. From this report he will be able to check the receipts against the purchase order.



PURCHASE ORDER – VENDOR'S COPY

JAMES L. McBRIDE
Corporation
1200 WOODMAN BOULEVARD
CHICAGO, ILLINOIS
PHONE LASALLE 6700

ORDER NO. 3864
DATE October 2, 1929
WHEN WANTED October 10, 1929
SHIP VIA Truck
F. O. B. Our Works
TERMS 2/10 Net 30

TO
Hambury Machine Company
185 South Hockley Street
Chicago, Illinois

FOR DEPT NO.	DISTRIBUTION NO
84	8.316

Please furnish the following, subject to conditions on bottom of this order.

QUANTITY	DESCRIPTION	PRICE
1	4-in. Split Pulley $1\frac{15}{16}$-in. Hole and $3\frac{1}{2}$-in. Face	$2.75

Send separate invoice for each order Each invoice must bear our order number.
Mail invoices and bill of lading immediately after shipment is made.
No charges are allowed for boxing or crating unless previously agreed.
If your terms are other than those stated in this order, please advise us at once.
This order is subject to modification in event of fires, strikes or other conditions beyond our control.
It is understood that promptness of deliveries of materials as specified herein shall be the essence of this order.
Unless otherwise agreed in writing, the sellers of these goods agree to assume the defense of any suit for infringements of patents brought against this company by reason of the use of such goods and indemnify said company against any damages or cost in such suits

CAR LOAD SHIPMENTS SHOULD BE ROUTED FOR UNION BELT DELIVERY ON MCBRIDE SIDING

BY Harry H. MacFarland
PURCHASING AGENT

Form 4: Purchase order.

Receiving Records

A formal report is usually made by the receiving department on every lot of goods received. This report shows full particulars of the goods, the kind, quantity, measurements, and other descriptive information, together with reference to the purchase order number under which they have been received. In or near the receiving department provision will be made for inspection, where the goods will be examined to see that they meet the specifications in all respects. Frequently the report of the inspector is incorporated in the receiving report; the document then gives full information about the shipment and calls for instructions as to the disposition of any goods rejected. One copy of the receiving report goes to the accounting department, to enable it to pass the incoming invoice for payment; another copy goes to the stores department, for posting to the perpetual inventory records. A form of receiving record, including the inspection report, is shown on page 64.

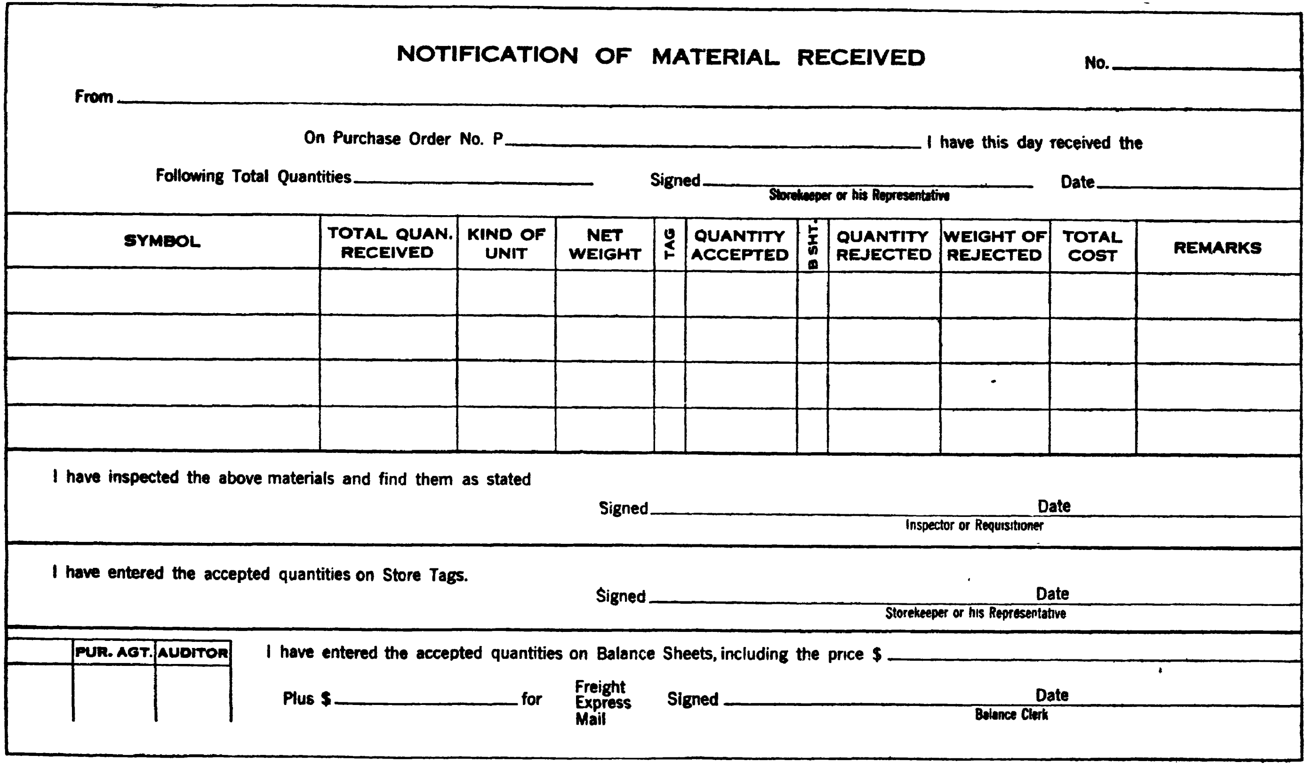
Inward Freight and Handling Expenses

The treatment of inward freight expense arises in connection with accounting for purchases. Inward freight is a cost of obtaining materials; strictly speaking it should be included in the value at which the materials are recorded in the stock records. This is the more true since some materials are purchased f.o.b. shipping point and others f.o.b. destination; the purchaser pays freight on some but not on others. In order to be uniform, all freight paid should be charged to the purchases on which it applies.

In practice this is often not done, largely because of a wish to avoid clerical work. If purchase transactions are numerous and for small items, it may be permissible to treat inward freight as an item of general overhead. In other cases, however, very little trouble is caused by attaching freight items to the specific goods on which they apply. When carload lots are purchased, for example, freight bills must be checked before they are paid, and in making this check it is a simple matter to indicate on the freight bill the purchase on which the bill applies, after which the bill may be charged to that purchase. The best rule to follow is that inward freight shall be charged to the materials on which it applies wherever this procedure can be followed without too much trouble.

Profits or Losses on Price Movements in Materials

In some businesses it is desirable that profits or losses made by the purchase of materials be segregated from profits or losses



NOTIFICATION OF MATERIAL RECEIVED No. ________

From ________

On Purchase Order No. P ________ I have this day received the

Following Total Quantities ________ Signed ________ Date ________

Storekeeper or his Representative

SYMBOL	TOTAL QUAN. RECEIVED	KIND OF UNIT	NET WEIGHT	TAG	QUANTITY ACCEPTED	B SHT.	QUANTITY REJECTED	WEIGHT OF REJECTED	TOTAL COST	REMARKS

I have inspected the above materials and find them as stated

Signed ________ Date ________

Inspector or Requisitioner

I have entered the accepted quantities on Store Tags.

Signed ________ Date ________

Storekeeper or his Representative

PUR. AGT.	AUDITOR

I have entered the accepted quantities on Balance Sheets, including the price $ ________

Plus $ ________ for Freight Express Mail Signed ________ Date ________

Balance Clerk

Form 5: Receiving record, with inspection report.

made on manufacturing operations proper; as previously stated, this is particularly the case if the business is in the habit of buying more materials than are needed for manufacturing purposes, in order to turn a profit on their resale. Such operations naturally have no relation to manufacturing, and separate record should be kept of the results obtained. Even when all materials are purchased for use in manufacturing, many business men desire to carry materials through the manufacturing stages at a standard cost; if actual purchases are above or below this standard cost, the amount of the variation is of interest and should be shown, especially when a standard line of goods is being made and quotations for them are given in a catalogue. Such quotations are necessarily based upon an estimated cost of materials, after which any variation from that estimate should be observed by the management. Some companies analyze invoices, as soon as they are received, into standard costs and variations therefrom; the standard costs are entered immediately in the records and afterwards carried to the manufacturing accounts. In this way the purchase variations are picked up immediately and shown in the reports to the executives. A form used as a "sticker" to be attached to invoices is shown in Form 6; on this slip the total invoice amount is divided into standard cost and variation therefrom, before the invoice is entered. The differences are therefore entered separately, and the total of them is posted to a purchase variations account.

Material Requisitions

When materials are moved from storerooms into process, it is usually necessary to make a requisition in writing; this requisition serves both as instructions to the storekeeper to deliver the items named and as a basis for recording the cost of materials so used. In some plants a separate form for the requisition may not be necessary; the works order may indicate what materials are required, and these materials may be obtained from the stores upon that information. In such cases the production order is used also as a record of the costs, and the materials will accordingly be entered immediately in the proper place on the production order.

In other plants the production orders may be sent to the various departments concerned, and the foremen, or clerical helpers in those departments, may write separate requisitions for the materials they require when they are ready to take up the orders. In still other cases a central planning department issues production orders to the departments and also determines the sequence in which they shall be executed. Copies of these production orders may also be sent to the stores, intimating when the materials necessary for the various orders should be delivered to the respective departments. Here again, therefore, the organization of the plant and the method of ordering work done will determine the type of records necessary for recording materials used.

APPROVED BY	VOUCHER NO.	INVOICE NO.

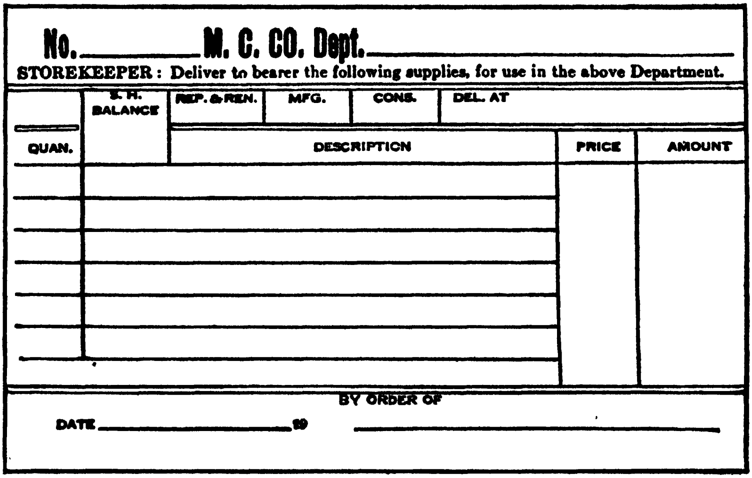
	ACTUAL COST AND PURCHASES DISTRIBUTION			
	ACCT. NO.	INVOICE	FREIGHT	TOTAL
DATE RECEIVED CHARGES PAID PRICES O. K. EXTENSIONS O. K. TERMS PAY ON				

STANDARD PRICE AND DEPARTMENTAL DISTRIBUTION

ACCOUNT NO.	CLASS	@	AMOUNT	LOSS	GAIN	TOTAL

Form 6: Invoice sticker, to analyze purchase prices.

The requisition, in whatever form it is drawn, should indicate clearly the department, process, or job which is to be charged for the materials named. The method of distributing material charges will depend upon the main plan of costing, as discussed in Chapter XV. If process costs are being gathered, as in a chemical plant or a food products industry, materials are charged to the process or department which uses them. Where, on the other hand, materials go into individual jobs, the costs of which the management desires to have, it is, of course, necessary to indicate the numbers of the jobs to which materials shall be charged. In still other cases, total costs are gathered by the month for different classes of products; the material requisition must then indicate to which class the materials apply. It is common to work out codes or symbols which will facilitate and make more accurate the charging of materials to proper departments or jobs.



No.__________ **M. C. CO. Dept.**____________________

STOREKEEPER: Deliver to bearer the following supplies, for use in the above Department.

	S. H. BALANCE	REP. & REN.	MFG.	CONS.	DEL. AT	
QUAN.		DESCRIPTION			PRICE	AMOUNT

BY ORDER OF

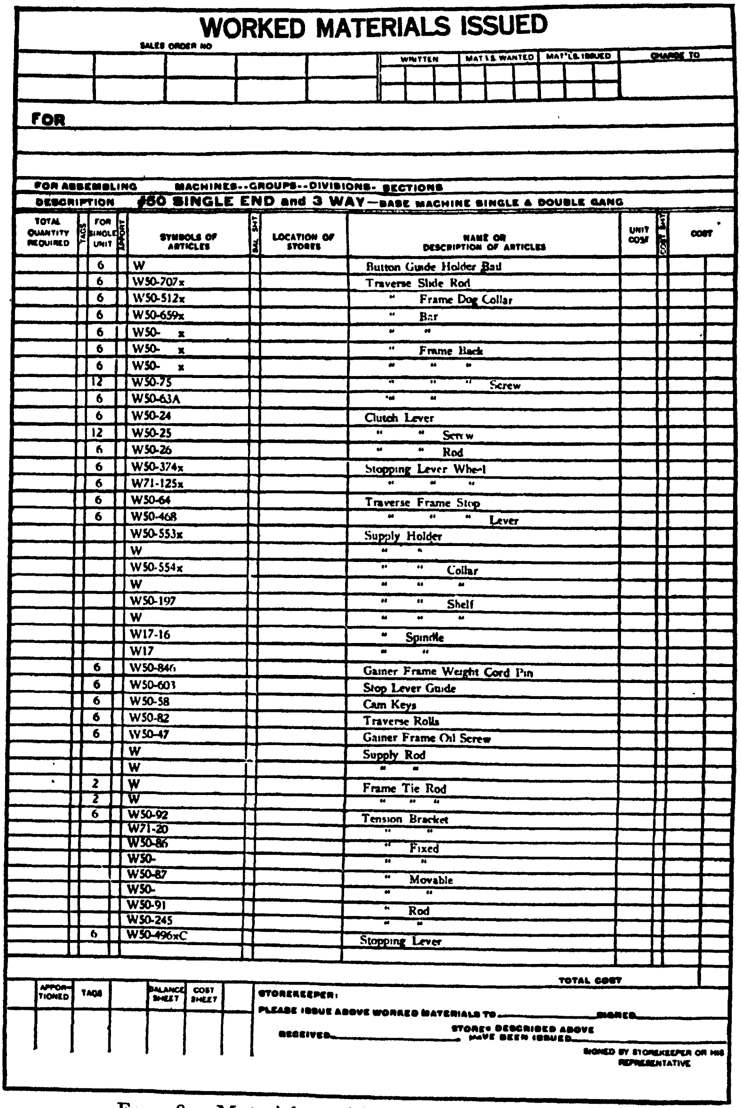
DATE________________19 ____________________

Form 7: Material requisition—for single item.

Sometimes a material requisition is designed to contain only one item of materials, as shown above on Form 7; in other cases the requisition covers all the parts necessary for a particular assembly, as shown in Form 8. The latter is often called a *bill of material;* where standard products are made, a standard list of the necessary parts is prepared, and for any given order it remains only to fill in the number of sets required.

Requisition Forms for Special Purposes

Where there are several storerooms for different purposes, and several accounts for materials, it is often helpful to use different forms of requisitions for these various purposes. Thus Forms 9 and 10 are used by the same company, but one is



WORKED MATERIALS ISSUED

SALES ORDER NO

WRITTEN	MAT'LS. WANTED	MAT'LS. ISSUED	CHARGE TO

FOR

FOR ASSEMBLING MACHINES--GROUPS--DIVISIONS- SECTIONS

DESCRIPTION #50 SINGLE END and 3 WAY—BASE MACHINE SINGLE & DOUBLE GANG

TOTAL QUANTITY REQUIRED	TAGS	FOR SINGLE UNIT	APPORT	SYMBOLS OF ARTICLES	BAL. SHT	LOCATION OF STORES	NAME OR DESCRIPTION OF ARTICLES	UNIT COST	COST SHT	COST
		6		W			Button Guide Holder Bail			
		6		W50-707x			Traverse Slide Rod			
		6		W50-512x			" Frame Dog Collar			
		6		W50-659x			" Bar			
		6		W50- x			" "			
		6		W50- x			" Frame Back			
		6		W50- x			" " "			
		12		W50-75			" " " Screw			
		6		W50-63A			" "			
		6		W50-24			Clutch Lever			
		12		W50-25			" " Screw			
		6		W50-26			" " Rod			
		6		W50-374x			Stopping Lever Wheel			
		6		W71-125x			" " "			
		6		W50-64			Traverse Frame Stop			
		6		W50-468			" " " Lever			
				W50-553x			Supply Holder			
				W			" "			
				W50-554x			" " Collar			
				W			" " "			
				W50-197			" " Shelf			
				W			" " "			
				W17-16			" Spindle			
				W17			" "			
		6		W50-846			Gainer Frame Weight Cord Pin			
		6		W50-603			Stop Lever Guide			
		6		W50-58			Cam Keys			
		6		W50-82			Traverse Rolls			
		6		W50-47			Gainer Frame Oil Screw			
				W			Supply Rod			
				W			" "			
		2		W			Frame Tie Rod			
		2		W			" " "			
		6		W50-92			Tension Bracket			
				W71-20			" "			
				W50-86			" Fixed			
				W50-			" "			
				W50-87			" Movable			
				W50-			" "			
				W50-91			" Rod			
				W50-245			" "			
		6		W50-496xC			Stopping Lever			

TOTAL COST

APPORTIONED	TAGS		BALANCE SHEET	COST SHEET

STOREKEEPER:

PLEASE ISSUE ABOVE WORKED MATERIALS TO __________ SIGNED __________

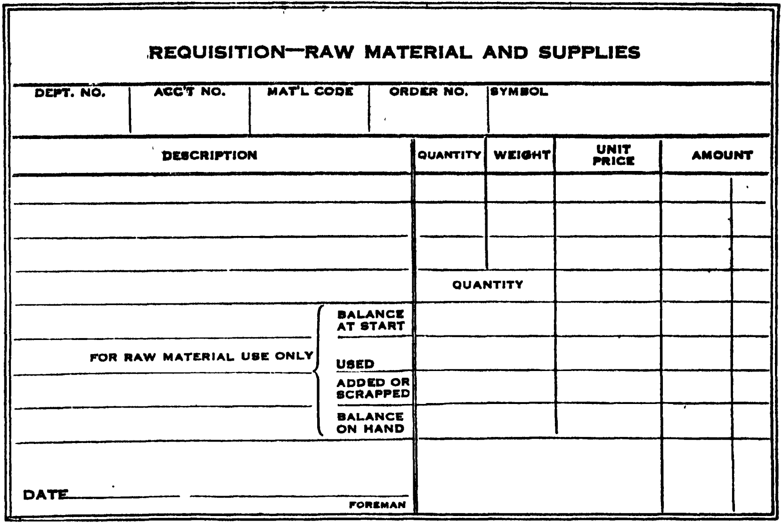
RECEIVED __________

STORES DESCRIBED ABOVE HAVE BEEN ISSUED __________

SIGNED BY STOREKEEPER OR HIS REPRESENTATIVE

Form 8: Material requisition—for groups of items.

for obtaining raw materials from the stores where they are kept, and the other is to obtain manufactured parts. The latter is for use in connection with Form 14, the inventory record of manufactured parts. On both forms spaces are



REQUISITION—RAW MATERIAL AND SUPPLIES

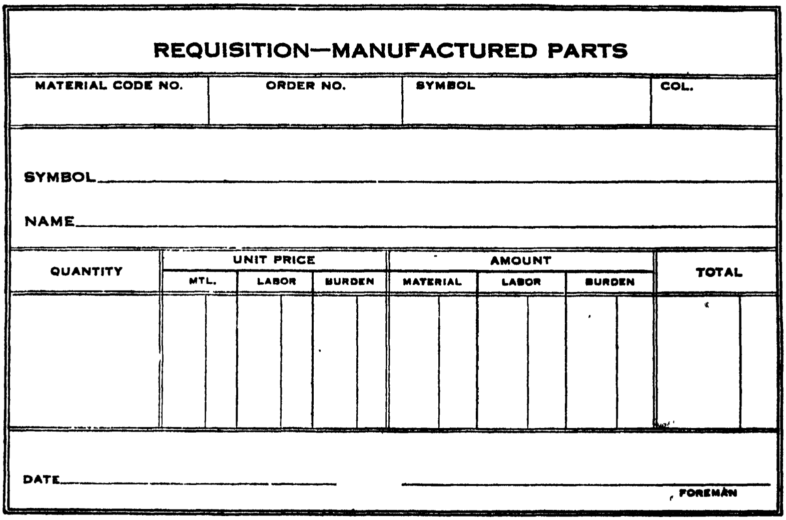
DEPT. NO.	ACC'T NO.	MAT'L CODE	ORDER NO.	SYMBOL

DESCRIPTION	QUANTITY	WEIGHT	UNIT PRICE	AMOUNT

FOR RAW MATERIAL USE ONLY		QUANTITY
	BALANCE AT START	
	USED	
	ADDED OR SCRAPPED	
	BALANCE ON HAND	

DATE __________ __________ FOREMAN

Form 9: Requisition for raw materials and supplies.



REQUISITION—MANUFACTURED PARTS

MATERIAL CODE NO.	ORDER NO.	SYMBOL	COL.

SYMBOL __________

NAME __________

QUANTITY	UNIT PRICE			AMOUNT			TOTAL
	MTL.	LABOR	BURDEN	MATERIAL	LABOR	BURDEN	

DATE __________ __________ FOREMAN

Form 10: Requisition for manufactured parts.

provided for the costs of the parts, to be stated in terms of materials, labor, and burden. This is because these parts have been made by the company itself, in other departments, and it is desired to find how much of each element of cost will be in the finished machines after they are assembled.

Pricing Materials for Manufacture

The next step is to put a price upon the materials. This may be done by charging the individual job or lot with the actual cost of those goods which were used on that particular job or lot; such a method requires that individual purchases of goods shall be separately identifiable in the stores. This in itself makes a good deal of trouble; and since it is only a matter of chance which particular goods go into any individual order, there is seldom any important advantage to be gained by charging materials in this way. A slight modification of this method is made by charging materials into process at the cost of a certain purchase until the *quantity* of that purchase has been used up; this removes the necessity for keeping individual purchases separate in the store. It is still true, however, that it is a purely accidental matter whether the materials, say in Order 4562, come out of the purchase of November 3 or out of the purchase of November 24. It is important for the management to note that the price has changed; and if estimates are being prepared as a basis for getting new business, the price changes should be fully noted in making these estimates. In costing for work in process, however, there is no particular point in charging to individual jobs all the little variations in purchase prices of materials.

Many firms, therefore, charge materials into process at an average cost of materials in stock at that time. This method ignores the differences between individual purchases, but it involves the extra clerical work of computing the average costs of materials on hand, and a new average must be reckoned every time additional materials are received at a price different from the average then in use. This computation is ordinarily made upon the balance of stores records, in which case it is desirable to provide a special column for that purpose.

From using an average cost it is but a short step to a standard cost. This standard cost will ordinarily be very close to what an average cost would be, but it is determined in advance, usually as the best estimate of what the materials are expected to cost over a certain period; sometimes, however, a standard cost for materials is an actual average of the cost over some past period. In any case, the standard cost is a predetermined figure and avoids the necessity for current computations of average costs. Standard costs are more fully discussed in Chapter XXI, but it may here be stated that they are coming to be more and more widely used in charging materials into process in many types of industry, whether on a job cost or process cost basis.

Accounting for Materials in Different Industries

Many variations from the general methods which have been described are to be found in different industries, some of which may be given here as examples.

In the case of a jewelry manufacturer using precious metals, such as gold or platinum, the chief care is for the safe custody of these materials. Subject to this, a quantity of metal is issued for the manufacture of a given number of pieces, which only approximates the exact quantity which will be required, since any surplus metal will be recovered as scrap with very little loss. The products are charged with the exact quantity of metal shown by the standard specification to be in them, plus a small standard allowance for loss or shrinkage. Jewelers who have followed this practice for a time, and have used care in their handling and recording methods, have found that the actual results come surprisingly near the standards set.

This same principle of the use of standards may be applied in an entirely different industry, where the unit values of materials are small, but the quantities very great. In the manufacture of automobile tires the buying prices of rubber fluctuate so much that it is common to compute an average price, say for a 3 months, period, which is used for charging rubber into the compound, based on the specification quantities. Standard charges for labor and burden are then added, and costs per pound are figured for the various kinds of rubber compounded; costs are computed in the same way for woven fabrics and other materials used in tire manufacture. After the cost of materials as they go into the finished tire is found in this way, the quantities for each size and type of tire are figured from the standard specifications, the quantity of each material per tire being multiplied by the number of tires made in the period. In this way standard quantities of materials used for the total number of tires produced during the period are ascertained, to which standard values are applied. The actual costs will indicate the variations from this standard, which may be divided into variations in the quantities of materials used and variations in the purchase cost of them.

Variations in Material Costs—Price

It is important to observe the variations in material costs, and one of the advantages of using standard costs is that they help in bringing these variations to light. There are two principal respects in which the material costs of a given product may vary. The market price at which those materials may be purchased may change, and the quantity of materials used to produce a given output may also change. As already stated, it is not necessary that all variations in purchase prices should be attached to individual jobs or lots of product; it is desirable, however, that the total amount of the variations in the cost of the several materials should be ascertained and communicated to the management. This is especially important where a standard product is being manufactured at a standard price which has been quoted to the public in a catalogue. In the manufacture of rubber shoes or rubber tires, for example, it is customary first to budget the estimated sales and next to estimate the cost of those sales, in which will be included an estimated cost of materials to be purchased. One of the duties of the cost department is then to show how far material costs vary from the estimates upon which the catalogue prices were set. It is clear, however, that such variations in purchase prices cannot be charged to the manufacturing departments. Only two questions can be raised with respect to them: first, whether the purchasing department is buying as well as it might; and, second, whether the estimating or forecasting process could be improved in the way of foreseeing more accurately what conditions are going to be. It is obvious that, in the type of business referred to, such estimating is an essential part of the success of the business. It can be eliminated only in those industries where the principal raw material may be bought on futures and a "hedge" set up whenever a manufacturing contract is undertaken. Even there varying losses and gains frequently occur from the fact that the manufacturer takes a "position" on the market, in an attempt to get his raw materials as cheaply as possible. Thus a cotton manufacturer may make losses or gains on his futures; such losses or gains are treated as an addition to or subtraction from the cost of cotton actually purchased.

Variations in Material Costs—Use

The other type of variation in material costs is in the quantities used; the manufacturing departments in a shoe factory, for example, may use more or less leather to manufacture a given lot of shoes than was estimated. This clearly is a matter for which the manufacturing departments should be held responsible. One advantage in eliminating purchase variations from purchase cost before the materials are charged into process is that, from that point on, any variations in the material costs of work in process will be variations for which manufacturing departments may be held responsible.

Much discussion has taken place as to whether it is desirable to keep track of variations in material costs by paper work or by physical inspection and supervision. The answer will vary in different industries, but in general both are desirable. If it is not expedient to keep a record in dollars and cents of the variations in materials used, it is at least desirable to keep some form of record of the quantities used. Such a record is, however, for the purpose of enabling the management to know what is going on rather than an immediate preventive or corrective of waste in the use of materials. For this purpose there is no substitute for vigilant inspection and supervision, though this can be aided by a system of prompt reports. Where waste and scrap are regular factors, it is necessary to provide for their removal every day, and in so doing they can be weighed, and a ratio between waste and production, or between waste and materials used, can be figured out. Ordinarily this will be sufficient check upon the movements of waste, and the amounts received from selling it may be treated as minor credits or deductions from the cost of manufacturing.

Accounting Records for Materials

The main features of the accounting records for materials are indicated by the following series of journal entries; the figures for these entries are obtained in part from the monthly totals of the purchase book or voucher register and in part by summarizing for the month the various records which have been illustrated in this chapter.

No record is made in the accounts proper for the requisitioning for purchase and ordering of materials; the memorandum records shown are sufficient for these purposes. But when goods are received and purchase invoices begin to come in, the monthly total of these will be recorded thus:

Raw Materials	$245,380	
To Accounts Payable		$245,380

If it is desired to record materials at a standard price, and if the standard cost of the foregoing materials is $243,500, the record would be as follows:

Raw Materials	$243,500	
Variations on Purchases	1,880	
To Accounts Payable		$245,380

The materials will now be in the stores; when they are taken out on requisitions and put into process, the monthly total of the materials so requisitioned will be recorded thus:

Work in Process	$236,900	
To Raw Materials		$236,900

The individual lots of materials will be entered as a charge on the cost of sheets for the specified jobs or lots for which they were required.

If raw materials were originally recorded at standard prices, they will now be taken out at standard prices; if the record of their purchase was at actual and they are taken out at standard prices, there is an adjustment to be made. This may be done by noting, for each requisition, the difference between the standard and the actual costs, and then taking the totals; thus, if the standard costs of the foregoing materials requisitioned are $235,000, the record, instead of the foregoing entry, will be:

Work in Process	$235,000	
Variations on Materials	1,900	
To Raw Materials		236,900

Frequently, however, it will be considered too much trouble to record the difference between standard and actual for every requisition of materials; instead, the matter may be left until the end of the year, when the totals in raw materials account may be as follows:

RAW MATERIALS

Beginning Inventory (Actual)	$ 35,000	Requisitions (Standard)	$235,000
Purchases (Actual)	245,380		

If now an inventory is taken, at actual costs, and entered on the credit side, it will reveal a discrepancy which should represent the difference between actual and standard prices on the materials used during the period; this difference may then be transferred to Variations on Materials, after which the account will appear thus:

RAW MATERIALS

Beginning Inventory (Actual)	$ 35,000	Requisitions (Standard)	$235,000
Purchases (Actual)	245,380	Inventory End (Actual)	43,480
		Variations on Materials	1,900
	$280,380		$280,380
Inventory Forward	$ 43,480		

The Voucher Register

In the foregoing paragraph have been shown, in simple form, the essential records which have to be made for purchases of materials. In actual practice the first entry in the account books proper is usually made in a purchase journal or in a voucher register, usually the latter, when the goods and the invoice for them are received. Such a book will provide a complete accounting record, suitable for posting to ledger accounts, and with the proper distribution of the charges indicated. Form 11 is an example of a voucher register, in which is entered the purchase called for in Forms 3 and 4. The voucher system assumes that each invoice or group of invoices from any one vendor will be paid specifically by check. Columns are therefore provided on the right side of the voucher register for recording the payment of each invoice or voucher; there is one voucher on each line, and lines which do not yet show a check number or date of payment indicate unpaid vouchers,

VOUCHER REGISTER

DATE	VOUCHER NUMBER	NAME	TERMS	DUE DATE	ACCOUNTS PAYABLE CREDIT
1929					
Oct. 9	8950	Hambury Machine Company	2/10, n/30	Oct. 19	2.75

Left Side

DEBITS								PAYMENTS	
MATERIALS	MFG. SUPPLIES	MFG. LABOR	MFG EXPENSES	ADMIN. EXPENSES	SELLING EXPENSES	OTHER A/CS.		DATE	CHECK NO.
						NAME	AMT		
	2.75								

Right Side

Form 11: Voucher register.

Accounts Payable Ledger

The voucher register may be used with or without a ledger of accounts payable; if such a ledger is used, then the voucher register is practically the same thing as a purchases journal, since both of them are then used to post all debits to materials or expense accounts, total credits to the accounts payable control account in the general ledger, and detailed credits to the individual personal accounts of vendors in the accounts payable ledger.

If, on the other hand, a straight voucher system is used, then a voucher is made out for every invoice, or for each group of invoices from one vendor; the entry of these vouchers in the voucher register, together with the notation of their payment in due course, makes a complete record of the purchases and settlement for them, without the use of an accounts payable ledger. The vouchers themselves are filed in two divisions, unpaid vouchers and paid vouchers. All references are to the voucher numbers, and by this number the record for any purchase could be found, either by its entry in the voucher register or by reference to the original voucher itself in the file. A voucher is simply a form which contains the principal facts of the invoice, together with approvals for its payment. On the other side the distribution of the charges is usually shown, that is, the accounts to be debited. Thus the voucher becomes the convenient form from which to enter purchases in the books.

Whether an accounts payable ledger should or should not be kept depends upon the requirements and conditions of the individual business. In many cases the dealings with one vendor may be frequent and complicated, making it necessary to keep a running account for that vendor in order to have the record straight. A bundle of vouchers would not be at all convenient in such a case, and it would be desirable to keep an accounts payable ledger, which would be posted up to date regularly and frequently and would therefore at all times show the position of each vendor's account. Where, on the other hand, individual transactions are clear cut and are settled individually or in groups, without deductions or part payments, the voucher register, with its notations of payments, is often found sufficient.

Purchase Invoices as a File Record

While the voucher register is often used as a means for getting rid of the accounts payable ledger, a still more simple short cut is sometimes found possible: by treating the file of purchase invoices itself as a journal and making no other journal record of them. Postings to the ledger are then made by means of a recapitulation or summary of all the invoices for a period, say one week; this summary is really in the nature of a journal entry, since it serves as a posting medium. The summary shows the total credit to Accounts Payable, and the amount of debit to each materials or expense account. This system is possible in those cases where prompt and frequent settlements of account are made; in some businesses, for instance, it is customary to pay accounts every week, so that at the end of each week no accounts payable are outstanding. When invoices are cleaned up in this way, no complicated account situations are permitted to arise, and the file of invoices, with its recapitulation, is a sufficient accounting record. The invoices for each week would be bound up in separate files. Obviously it is not expected that back references to these invoices will be very frequent; a particular invoice could be found by knowing its date and going through the file for that week; but if such references were common, a more detailed and convenient record would become necessary, and then it would be advisable to use a purchases journal or voucher register.

QUESTIONS AND PROBLEMS

1. In your opinion, should a manufacturing company, in buying its materials, try to take advantage of the ups and downs of market prices, or should it buy strictly according to manufacturing requirements? Discuss the question.

2. What is the difference between a requisition for purchase and a requisition for goods into process? What does each accomplish?

3. State what memorandum records will be made in connection with the following facts; do not make the records.

The stores department of the Hawarth Machine Works supplied, upon request, 5 tons of bar steel to the machine shop; this brought down the stock on hand to a very low point, and the storeskeeper accordingly notified the purchasing department. After securing quotations, the purchasing department ordered 40 tons of bar steel from the Hallam Steel Company; the steel was duly received, inspected, put into stores, and paid for.

4. The following is a trial balance of the Hawarth Machine Works on January 1, 1929:

Cash	$ 40,000	
Accounts Receivable	65,000	
Plant and Machinery	194,000	
Accounts Payable		$ 37,000
Capital Stock		300,000
Surplus		61,000
Sales		
Raw Materials (Standard)	53,000	
Work in Process	46,000	
Variations in Purchase Prices		
Freight on Purchases		
Purchase Returns		
Manufacturing Expenses		
	$398,000	$398,000

a. Using only the accounts given, prepare journal entries to record the following summary of January transactions:

Raw materials purchased on account—standard value, $78,500, invoice value, $79,900.

Freight on materials, $5,900.

Materials rejected by inspector and returned to vendors, $2,200; these items were deducted from invoices before entering them in the records.

Materials found defective after being entered in the books, $1,950; these were returned to vendors and credit obtained.

Manufacturing expenses paid, $127,000.

Sales of finished goods, on account, $247,800.

Cost of finished goods sold, $223,700; they were shipped direct on completion, there being no stores of finished goods.

Raw materials were requisitioned into process at prices calculated to include the standard purchase price plus inward freight; the total amount of such requisitions was $93,400.

Cash received on account, $254,500.

b. Prepare a trial balance after these entries have been posted.

c. Prepare journal entries to close the books.

d. Prepare a trial balance after closing.

e. Do you consider your inventory figures reliable at this point? Explain.

5. A company manufacturing filing equipment and supplies found it too expensive to account for the actual small sundry materials entering into the manufacture of various filing supplies. The total of such items, however, represented an appreciable expense, which should have been borne by the products. It was decided that each manufacturing order should be charged for such quantity of sundry items as was called for on the specification sheets, priced according to the inventory records, without accounting for the actual materials requisitioned and issued from the storeroom. When the year-end inventory was taken, it was found that the actual inventory of sundry materials was $5,000 less than the book figure. In other words, more sundry materials had been taken out of stock than had been charged to the products.

a. What journal entry should be made to adjust the inventory account?

b. What steps might be adopted to correct this condition in the future?

6. To whom should the purchasing agent be responsible?

7. By what means might the efficiency of the purchasing agent be tested?

8. Should the receiving department be notified, at the time goods are ordered, of the quantities ordered?

9. The following list of accounts includes all those which related to the operating income and expenses of the Nichols Corporation for the year 1931:

Raw Materials Inventory, Jan. 1, 1931	$ 64,000	
Work in Process Inventory, Jan. 1, 1931	38,000	
Finished Goods Inventory, Jan. 1, 1931	97,500	
Raw Materials Purchased	288,000	
Supplies	29,000	
Direct Labor	198,500	
Indirect Labor	54,000	
Property Taxes	17,000	
Insurance	2,500	
Depreciation	33,000	
Repairs and Maintenance	26,000	
Selling Expense	68,000	
Administrative Expense	36,000	
Discounts on Purchases		5,500
Discounts on Sales	7,000	
Purchase Variations	19,500	
Sales		744,500

At December 31 the inventories were:

Raw Materials, at cost, $66,500; at market, $58,000; at standard, $65,000. The corresponding inventory at January 1, 1931, was valued at standard.

Work in Process, $36,500.

Finished Goods, $94,000.

a. Prepare the income statement for the year 1931.

b. Prepare ledger accounts for all the items listed; enter in them the balances given.

c. Prepare closing journal entries; post them, and close the accounts, using such additional accounts as may be required as clearing accounts.

VII

INVENTORIES—PHYSICAL AND BOOK

Arrangement of Stores

A convenient and orderly arrangement of materials and supplies in the storeroom is necessary in any plant. Disorder is almost certain to bring loss from spoilage, as well as to result in buying more materials than are necessary, because materials actually on hand cannot be found. For materials for which there is no written record it is especially necessary to have the bins or containers convenient for inspection, so that the storeskeeper may easily see when it is time to reorder. Most materials, however, will be recorded on inventory cards. Parts which are to go into the same assemblies should be stored near together so as to be convenient for collection and delivery to the assembly room. For standard assemblies, complete sets of parts are sometimes held ready at the delivery counter in a sort of reserve stock; when orders are received for these assemblies, the reserve stocks of parts may be handed out instantly and then replaced from the general stores at the convenience of the storeskeeper. The particular form of containers will, of course, depend upon the nature of the goods to be stored.

A further modification in stores arrangement occurs when several different storerooms are used, each one serving a different department. When the plant is a fairly large one and different products are made in the different departments, this provision of several storerooms is a great convenience and makes possible better service to the manufacturing departments.

There have been great advances recently in the contrivances designed to help in handling stores. Special scales for weighing materials in and out; boxes and containers holding definite known quantities; trucks and carriages designed specially for the materials to be handled; all help to solve this problem not only as to the physical handling but also in laying the basis for materials accounting.

Inventory Control Records

It has become common to keep detailed records of inventories, to have one account for every item in the stores, showing the quantities received, the quantities issued, and the balance. These records are frequently in card index form, sometimes in sheets filed vertically, sometimes in bound books, in which case the "visible" forms described in Chapter XXIII are to be preferred.

For purposes of sound and reliable cost records it is necessary to have complete records of materials; what is more, such a record will help in the working out of a satisfactory arrangement of the physical stores themselves. A perpetual inventory record, or balance of stores record, as it is frequently called, is not limited in its usefulness to cost accounting purposes; even more important is the service it renders the factory management in helping to keep the inventory in good order, both as to its arrangement and as to its contents. For this reason the perpetual inventory, with its accompanying features, is often referred to as a control of stores.

There are four important things which a control of inventory should accomplish: first, it should operate to insure the presence of adequate stocks of all materials at any time, so that work will not be delayed because parts or supplies are out of stock; second, it ought to prevent the investment of too much money in the inventory in having unnecessary quantities accumulate; third, it should serve to call attention to obsolete and slow-moving stock, until a satisfactory disposition of it can be found; fourth, the inventory records are valuable in making a fire adjustment with the insurance company in the event of fire. One of the first steps, therefore, is the determination of stores quantities, that is, the fixing for each item of a maximum quantity which shall not be exceeded and of a minimum quantity below which the stock shall not be permitted to go. Along with these it is necessary to determine the quantity of each item which shall be ordered when the minimum quantity is reached.

Stores Quantities

The minimum quantity, the reorder point, will be fixed largely with reference to three factors, namely, the rate at which that particular item is consumed, the time which will be taken to obtain new quantities, and the size of the order which it is economical to make or to buy. Thus, if a certain item is used steadily at the rate of 1,800 pieces per year, and if it takes a month to get new supplies, then clearly there should be at least a month's supply, or 150 pieces, on hand at the time when further supplies are ordered. But a margin of safety is also necessary, partly to cover unforeseen delays in getting the new materials and partly to take care of any unusual demand for the item in question. This margin of safety will vary, in different plants, according to the extent of the fluctuations in demand; but if the business is a decidedly seasonal one, it will probably be necessary to have one set of maximum and minimum quantities for the busy season and another set for the dull season; it would be foolish to carry the same full inventories in both seasons. In fact, some manufacturers vary their stores quantities from month to month in accordance with their production schedules.

Relation of Inventories to Budget

The rate at which raw materials are consumed depends, of course, upon sales of finished products, and in this way the determination of stores quantities must rest ultimately upon the budget. Here the sales of finished products are estimated; calculation is made of the quantities of raw materials necessary for this volume of sales. Allowance is then made for the inventories of raw materials, in process, and finished goods now on hand, and for the corresponding inventories desired at the end of the budget period. The budget also shows the rate at which sales are expected to be made, and from these data may be computed the quantities of raw materials which it is necessary to have on hand from time to time. More is said about this matter in Chapter XXV relating to the budget, but it cannot be too strongly emphasized that all these questions of inventory quantities depend upon sales, and the budget is the place in which these matters are related together.

✓Rate of Inventory Turnover

Another aspect of inventory control which has received very close attention during recent years is the matter of inventory turnover. For raw materials this figure is, of course, the total quantity of an item used during a given period, divided by the average inventory held. One notable feature of the depression of 1929–1932 has been the relatively small losses from inventory declines, as compared with the depression of 1920–1921. While it is true that manufacturers who necessarily carried stocks of such raw materials as cotton or copper through the more recent period were forced to witness a constantly declining value in their holdings, yet these losses were undoubtedly kept to a much smaller figure than in the earlier depression; and in the case of finished goods, inventories were kept so extremely low in order to secure a more rapid turnover that direct inventory losses here were kept down to remarkably small limits. Whether these extremely small inventories were in all cases wise is an open question; to some extent they themselves contributed to the acuteness of the depression by lowering the general rate of manufacturing activity. Nevertheless, it is natural for the individual business to carry the least possible inventories in falling markets. Here again the best results are accomplished by those companies which are most successful in their budgeting and sales forecasting.

The Margin of Safety

One well-known company allows the margin of safety, over and above the average quantity used within the order period, to vary between 25 and 100 per cent of that quantity; the smallest percentage is applied to goods used in large quantities, and the largest percentage to goods used in small quantities. If, for example, a certain part is used at the rate of 50 a month, a margin of safety of 100 per cent might be applied and a minimum quantity of 100 pieces would be adopted; if in the same plant another piece is used at the rate of 2,000 per month, probably a margin of safety of 25 per cent would be considered sufficient, and a minimum quantity of 2,500 would be adopted. This arrangement is made for two reasons: the small quantities are relatively more liable to variation than are the large quantities; and furthermore a small quantity can be doubled without seriously increasing the amount of money tied up in inventory, while an increase from 2,000 to 2,500 pieces will involve more money.

Some companies compute these stores quantities entirely from their past records; they assume that no material variations will occur in the near future. Other firms base the inventory quantities upon their estimates as to what the sales of the coming period will be. If the budgeting and forecasting procedure is pretty well developed, it is undoubtedly better to use the estimated figures for the coming period rather than to rely solely on past figures. Manufacturing orders or "sanctions" are then carefully worked out, and these will govern the quantities needed in stock from time to time.

Order Quantities

The main considerations in arriving at the quantity to order depend upon whether the parts in question are to be obtained from another department of the same plant or are to be purchased in the open market. In the former case, the order quantity will depend almost entirely upon internal considerations, namely, the time taken to put through an order for the part required, and the economical run. If the goods are to be purchased from another company, however, current prices are bound to be considered; some plants give their purchasing agents considerable discretion as to when to purchase, while others follow their manufacturing requirements more closely and disregard price movements. The latter policy, as already stated, is in general the safest but is sometimes difficult to follow except where price movements are comparatively slight, or where, as in the case of cotton or wheat, it is possible to hedge against price changes.

Form of Inventory Card

A typical perpetual inventory card, as used by a paper manufacturer, is illustrated in Form 12; it contains spaces for the descriptive details about the part to which it refers, and for the control quantities. The columns provide that materials shall be deducted from the inventory, in the Stores Apportioned columns, as soon as manufacturing orders have been issued for them, without waiting until the goods are actually removed from the stores. If the order system is such that this can be done, a more prompt control of stores is effected than by entering the quantities in a Stores Issued column after they have been delivered to the operating departments. It will be noted also that unit price and value columns are provided only under the heading Stores on Hand; some inven-

NAME OF ARTICLE							STANDARD PRICE			WHEN AVAILABLE QUANTITY FALLS TO		·ISSUE ORDER FOR			CODE NO.	
STORES ORDERED				STORES ON HAND						STORES APPORTIONED					STORES AVAILABLE	
													Order No.			
Date	Quantity	Date Rec'd	Purchase Order No.	Date	Quantity	Value	Unit Price	Date Iss'd	Issued for Order No.	Date	Quantity	Promise Date	Production	Dept	Date	Quantity

Form 12: A form of perpetual inventory record.

ORDERED AND RECEIVED							ISSUED						ISSUED					
DATE	ORDER NO.	INVOICE NO.	QUANTITY ORDERED	DUE	QUANTITY RECEIVED	UNIT COST	DATE	REQ NO	DEPT.	PROD ORDER	QUANTITY	BALANCE	DATE	REQ NO	DEPT.	PROD ORDER	QUANTITY	BALANCE

Form 13: A simpler form of inventory record.

tory records are kept entirely in quantities, with no reference to money values. Which plan shall be followed depends upon whether or not the perpetual inventory is used to furnish information of material costs for purposes of costing the product or of valuing the inventory at stocktaking. The space at the top for Standard Price suggests that materials are charged into production at standard prices.

A somewhat similar form, used by a manufacturer of chemicals, is shown in Form 13. The unit cost of each quantity received is given, but issues are recorded by quantity only. Stores used are entered only when withdrawn for a production order; twice as much space is given for issues as for receipts, and the balance on hand is given after each issue.

Still more simple forms are sometimes used, especially for supplies which are to be charged to expense. For this purpose a form containing only columns for Date: Received: Date: Issued: Balance may be used, while a more complete record is made of the inventory of manufacturing materials.

Materials Partly Used

A problem exists in many factories with materials which have been issued from stores to the manufacturing departments, but which have not yet actually entered into process. As far as possible materials should be issued in the precise quantities and at the times when they are wanted for actual manufacturing operations, but this cannot always be done. It is not worth while to go to too much trouble to divide materials into very small quantities or to keep records of them in minute figures. In a factory making paper novelties, for example, coloring materials are used in frequent small quantities in the manufacture of papers of various tints. Theoretically it would be possible to weigh out the exact quantity of each color required for each manufacturing order and to issue these from the stores on requisitions, with corresponding credits to the Stores and debits to Work in Process. In practice it is often found more convenient to issue entire kegs of coloring matter from the stores and to rely on the foreman of the color mixing department to see to it that this material is carefully and properly used; the simplest record is then to credit stores and charge work in process for the entire quantities issued from stores. In so far as considerable quantities of these coloring materials may remain unused in the mixing department, this results for a time in an excessive charge to operations. But if the plant is a good-sized one, using many complete kegs of coloring matter, these discrepancies are relatively small and will average out. Partly used kegs on hand in the mixing department at the beginning of the period, and charged in the preceding period, will be used up during the current period, thus making up for excessive charges for kegs issued during the period and not completely used.

This is a matter which should be carefully studied in each individual case, and the most convenient method will be chosen, provided it does not bring too much inaccuracy.

Manufactured Parts Inventory

When production is of the parts and assembly type, and the final product is, for example, a machine consisting of parts manufactured in earlier departments of the plant, then there will usually be a stores department containing manufactured parts waiting to be assembled. In fact there may be as much money tied up here as in the raw materials stores, and it is equally important to control them efficiently and economically. For this purpose a special form of inventory record is often used; or it may be that the rulings are alike, but a card of one color may be used for the raw materials inventory and another color for manufactured parts.

Form 14 shows an inventory sheet for manufactured parts. In this case, orders are manufacturing orders issued to other departments where parts were made, and the parts were received from those departments. Furthermore, this particular company desired to keep separate record of material cost, labor cost, and burden cost throughout all processes of manufacture, so that, when the assembled machine was completed, it was possible to state the total value of materials, labor, and burden in it. In order to do this the value of all parts received was recorded, in terms of cost per hundred, subdivided into Labor, Burden, Material. These costs were taken from the cost sheet records when the various lots of parts were made. Later, when the parts were issued to be assembled into machines, these figures would be used in the analysis of the machine costs.

If this procedure were not followed, the parts used in assembly would be charged as materials and would so appear in the

MANUFACTURED PARTS

MAXIMUM________

NAME________ MINIMUM________ SYMBOL________ COL.________

RECEIPTS								DISBURSEMENTS					BALANCE	
ORDER NO.	QUANTITY		COST PER HUNDRED				AMOUNT	DATE	ORDER NO.	QUANTITY ISSUED	UNIT PRICE	AMOUNT	QUANTITY	AMOUNT
	ORDERED	RECEIVED	MATERIAL	LABOR	BURDEN	TOTAL								

Form 14: Inventory record of manufactured parts.

final costs. Only the labor and burden costs of the assembly department would appear in the final costs as Labor and Burden; the labor and burden of the departments making the parts would come through as material costs, which would not give a correct picture for the whole company. The assembly cost sheet in which the parts cost was finally shown, subdivided into Labor, Burden, and Material is shown on page 90.

Goods in Process Inventory

Much more difficulty occurs in keeping an up-to-date inventory record of goods in process than is the case with raw materials in stores or finished parts, because of the rapidly changing character of work going through the shops. If a complete order cost system is in use, by which all goods are manufactured under a specific order number, and for each order number there is a cost sheet to collect the costs of that order as the work progresses, then these cost sheets themselves furnish an inventory of work in process. All materials issued into process are entered on the proper cost sheet; the labor tickets for work done on that order are also entered; if then the proper burden charges are added, as will be described later, these cost sheets, when written up to date, show the complete cost of the work as it now stands, and this cost is ordinarily its inventory value. A complete inventory of work in process would then be found by adding up the totals of all the cost sheets for all orders in process at the time.

Where complete order costs are not kept, the problem is more difficult. It is then not possible to have a continuous inventory record, but various methods are used to obtain a computed inventory at the end of each month, or whenever it may be desired for making statements. Broadly speaking, the value of the inventory at any one time is the sum of the materials, labor, and burden charged into process, less the value of the goods completed and taken out of process. It will be seen later that certain adjustments have to be made in the course of this computation; but if all the terms mentioned can be found, it is usually possible to get the value of the work in process inventory. In many cases, however, a physical inventory has to be taken, because of the lack of any satisfactory method of obtaining a book or recorded inventory.

Gross Profit Method

One of the methods for computing the approximate value of an inventory is called the gross profit method, because it uses the average gross profit made on sales. The amount of sales for the period is always known from the regular accounts; from this figure is deducted the average or normal gross profit; the remainder is then assumed to be the cost of the goods sold. This can be used as a credit in the Work in Process account in order to find the inventory in process at the end of the period. After a little experience a number of companies have been able to bring this method to a point where it gives them fairly reliable monthly statements; at the end of the year, when a final annual statement is required, it is usual to check up the inventory so computed by taking a physical inventory. If the method has been well worked out, there should be very little discrepancy between the computed inventory and the book inventory.

Inventory of Returnable Containers

Another form of inventory problem occurs where goods are shipped out to customers in containers which are returnable to the manufacturer. Chemicals and other liquids are shipped in barrels, drums, carboys, and other containers; flour, feed, and cement are shipped in bags; in many cases the containers are valuable enough for a separate charge to be made for them to the customer; this charge the seller agrees to cancel when the customer returns the container. In general, therefore, the customer does not pay these charges for containers but pays only for the contents and intends to return the containers for credit. This is one of the reasons for making the charge in the first instance; if no charge is made, the customer is likely to become negligent about returning them.

The manufacturer owns all these containers, but some of them are on his own premises and some on the premises of his customers. About the latter there is, of course, an element of doubt, but at any rate the manufacturer is liable to buy back all of them which may be returned to him. One of the difficult things about such a situation is that these containers are likely to come back, and the money for them to be claimed, at most inconvenient times. During periods of good business, customers will neglect to return them, accumulating considerable quantities of containers on their own premises; but when bad times come, and the customers begin to feel the pinch, they immediately proceed to gather up all these containers and to send them in with claims for repayment. This makes a situation where the manufacturer needs to keep an inventory record as accurate as possible and also an account of the amount of liability attaching to this part of the inventory.

Records for Returnable Containers

For this purpose it is desirable, when goods are shipped in returnable containers for which a charge is made, to separate the value of the containers from the value of the contents. The value of the containers will not be credited to Sales; the credit will be to an account called Liability on Containers; the corresponding debit will be to Accounts Receivable, in combination perhaps with the debit for the contents. Whenever any containers are returned, a record will be made which cancels the liability on them by debiting Liability on Containers. If the customer has previously paid for them, they must now be redeemed in cash; if not, his account will be credited, and so the credit for this part is to Accounts Receivable, as shown in the third entry in the series below, which illustrates the entire process.

Containers—Tight Barrels (2,000 @ $3)	$ 6,000	
To Accounts Payable		$6,000
To record purchases of containers		
Accounts Receivable	10,000	
To Sales (for contents only)		6,000
Liability on Containers		4,000
To record billings of the month of 1,000 bbl. of goods		
Liability on Containers (750 @ $4)	3,000	
To Cash (250 @ $4)		1,000
Accounts Receivable (500 @ $4)		2,000
To record returns of containers from customers, and allowances for them		

Detailed records will be kept to show the number of containers shipped to and received from each customer. This record often consists only of notations on the customers' accounts in the regular accounts receivable ledger; but if the transactions in containers are very numerous or amount to much money, it may be desirable to keep a separate record, perhaps in the form of a card index, parallel to the accounts receivable ledger, and to enter in this the respective debits and credits for containers shipped to and received from each customer.

Adjustments for Container Losses

Periodically it will be necessary to make records of the losses on containers, that is, for containers shipped out and never returned. For this purpose an estimate must be made, based on the best information available, of the number of containers' still in the hands of customers which from neglect or other reasons they probably will not return for credit and the amount charged to them. Obviously this estimate must be conservatively made, as otherwise the liability for returnable containers will be unduly reduced. But when the best conservative estimate has been arrived at, an entry will be made debiting Liability on Containers for the redemption value of them, crediting the original Inventory account for containers at the cost value, and crediting Profit and Loss for the balance. The situation is now the same as if the barrels which had been purchased at $3 had been sold to customers at $4. This adjusting journal entry will be as follows:

Liability on Containers (50 @ $4)	$200	
To Containers—Tight Barrels (50 @ $3)		$150
Profit and Loss		50
To make adjustment for lost containers		

Purchasing in Mass-production Industries

Recently a new form of inventory control has been used, chiefly in the mass-production industries, such as automobile or typewriter manufacture. Here the scheduling of production has been brought to a very high degree of perfection, and purchasing has been adapted to these production schedules with remarkable accuracy. Great efforts have been made to reduce the time between the receipt of raw materials and the shipment of the finished products containing them. In fact the whole purpose is to control purchasing and manufacturing operations by shipments of finished cars to customers. All materials and parts are classified on a time basis, called by various names in different companies, but its meaning is simply the number of days between the ordering of materials and their shipment in the shape of finished goods. Thus certain parts are said to be on a 10-day basis or a 12-day basis or a 9-day basis; the last means that 9 days are required between the ordering of those parts and the time when they will be shipped from the factory as finished goods. Constant efforts are made to reduce the time basis for the various materials. So successful have some companies been in this direction that they carry no raw material accounts nor accounts for unfinished parts but only work in process accounts; it is assumed that all materials received will go immediately into process. It is largely by unceasing efforts of this kind that the cost of production of automobiles has been so greatly reduced.

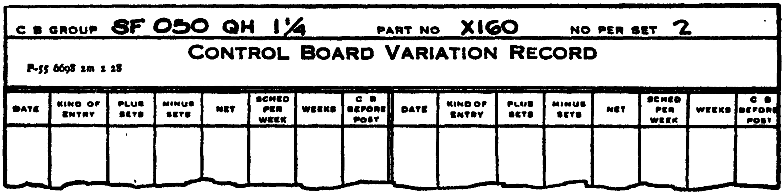
Inventory Control by Scheduling

Where purchasing is carried on as described in the preceding paragraph, inventory records have been greatly modified in accordance with those methods of purchasing and inventory control. The card-index type of inventory record, as illustrated in Form 12 on page 86, has been done away with in such cases, and various substitutes have been adopted in its place. One method is to design the production scheduling records so as to serve the purpose of the inventory record. A card index of materials and parts is used, which in appearance resembles the perpetual inventory record but is in use very different. The scheduling record shows, on the card for each part, what will be the weekly requirements of that part, as determined by the general production schedule. Then the other columns of the record are designed to show what purchase orders are placed to fulfill these scheduled requirements, and how the goods are received. These records are then closely watched to see that everything is moving in accordance with the schedule. It will be seen that under this plan the records indicate what is *scheduled* or planned *in advance;* whereas the ordinary inventory record shows what *has been* ordered, what *has been* received, and what *has been* issued from stores.

Inventory Control by Graphic Methods

A still further advance is shown when even the card index based on scheduling is abolished and the same work is accomplished by means of graphic charts. These also are based upon the production schedules and upon the time required between ordering materials and shipping the finished goods. Colored lines are drawn, or colored strings are used, to mark off distances on the chart to indicate the quantities ordered for delivery, this, of course, being strictly in accordance with schedule. Lines or strings of other colors are used to indicate deliveries or receipts of materials under the purchase orders. If these receipts of materials are in accordance with schedule, and production is also on schedule, then the inventory on hand must be the quantity required for the time basis for that

Form 15: Operation of control board.



C B GROUP SF 050 QH 1¼ PART NO X160 NO PER SET 2

CONTROL BOARD VARIATION RECORD

P-55 6698 2m 2 28

DATE	KIND OF ENTRY	PLUS SETS	MINUS SETS	NET	SCHED PER WEEK	WEEKS	C B BEFORE POST	DATE	KIND OF ENTRY	PLUS SETS	MINUS SETS	NET	SCHED PER WEEK	WEEKS	C B BEFORE POST

Form 16: Control board variation record.

part. For example, if Part 856E is scheduled to be used at the rate of 800 per day, and it is on a five-day base, then the scheduled inventory is 800 × 5 = 4,000 parts. Everything will then be done to see that this schedule is adhered to, and 4,000 parts will be assumed to be the inventory, unless a report is made of that part being off schedule. Thus the entire inventory record for all materials and parts consists of (1) the scheduled inventory, (2) additions to or subtractions from this scheduled inventory, as shown by a report on materials off schedule. Such a report is shown in Form 15, page 96.

The Physical Inventory

In these days of perpetual inventory records, there is much discussion as to whether a complete physical inventory, with the accompanying inconvenience and interruptions of operations, is really necessary. There are two schools of thought on the subject, and it has already been stated that some well-known accountants prefer to rely upon a book inventory which has been perfected from years of experience rather than upon a physical inventory. It still remains true, however, that the great majority of businesses do take a physical inventory at least once a year. They take inventory not only for the purpose of checking the perpetual inventory record, if one is kept, and not only for the purpose of getting a reliable inventory figure for inclusion in the balance sheet and in the income statement; even more important than these reasons, in many cases, is the desire of the executive heads to have a clean-up of the factory. They want to take the opportunity to have their stock arranged in better order, to observe dropped and slow-moving items, and to dispose of the miscellaneous lots which have been left lying about during the busy season.

Modern ideas on this subject, therefore, run in the direction not of abandoning the physical inventory entirely but of shortening the time, simplifying the procedure, and getting more accurate results. It has come to be axiomatic that this work should be done in the dull season, when business is at its lowest activity; the inventories of the last season have then been largely disposed of, and those of the new season have not yet come in.

As a practical matter, moreover, it sometimes occurs that it is easier and cheaper to take periodic physical inventories rather than to keep continuous inventory records. The proprietors will then wish to follow the former method, unless the inventory records aid them substantially in managing the inventory.

Checking the Book Inventory

The best combination of a book or perpetual inventory and a physical inventory is obtained when the inventory record is carefully kept, and a few items of it checked every day by actual count. During the course of the year it should be possible to count each item at least once, and in some cases several times; all the benefits of a complete physical inventory are thereby secured, without the disturbance of a general shutdown. Companies which do this usually have a form to show the comparison between the record and the actual count; Form 17 is particularly good for this purpose, since it wastes no time and space on items which are found correct but lists in detail all which are found to disagree. The form is arranged for the easy computation of the necessary adjustment on the whole series, and the number of inventory cards checked and found correct is also noted. Differences are summarized, and at the end of the month are written off into Loss or Gain on Inventories.

Another useful idea is to check every item when it reaches the low point at which new orders are placed; this reduces the amount of counting necessary.

Inventory Adjustment Entry

It is likely, on the check-up, that some items will be over and some short. In that case it is only necessary to adjust the control accounts for the net differences, although each individual item will be changed as needed in the perpetual inventory records.

Thus suppose, on checking up eight items, the actual count differs from the records as follows, giving the values only:

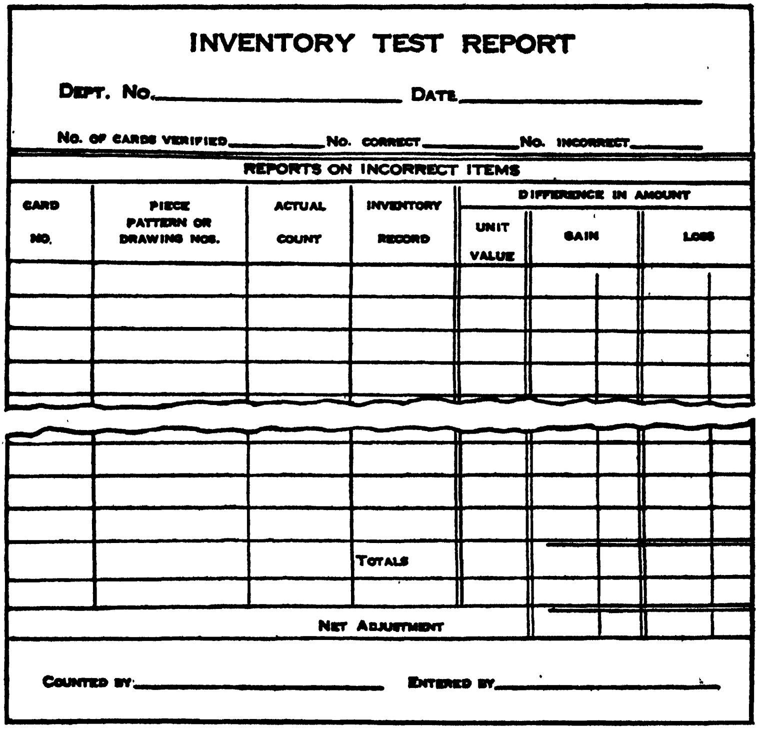
Item	Over	Short
387		$ 1.36
395		4.60
409	$1.09	
416		3.75
422	2.50	
440		.95
446		2.16
461		1.40
	$3.59	$14.22
Net difference........	.....	10.63

Then each of the eight cards for the eight items will be adjusted for the exact amount required to make them agree with the actual counts, but in the financial books the entry will be:

Profit and Loss	$10.63	
Inventory, Raw Materials		10.63
To adjust inventory record to actual count		

Preparing for the Physical Inventory

When a physical inventory is wanted, it is desirable that definite instructions in writing be prepared well in advance and placed in the hands of all who will participate in the taking of inventory. A prominent officer, perhaps the works auditor or the comptroller, will be in general charge of the stock taking, and the instructions should make it clear who is responsible for the various parts of the work. It is essential that the listing and counting of the materials be done by people who are familiar with them. This means in many cases that it cannot



INVENTORY TEST REPORT

Dept. No.______ Date______

No. of cards verified______ No. correct______ No. incorrect______

Reports on incorrect items

Card No.	Piece Pattern or Drawing Nos.	Actual Count	Inventory Record	Difference in Amount: Unit Value	Difference in Amount: Gain	Difference in Amount: Loss
			Totals			
Net Adjustment						

Counted by______ Entered by______

Form 17: A form to check the perpetual inventory.

be a purely clerical job, and it is necessary for the foremen of the various departments to give their services in the stock taking. Unless the executive heads of departments are thus brought in, a staff of clerical helpers is not likely to get entirely accurate results.

Detailed instructions should also be given about the cleaning up and arrangement of stock prior to the taking of a count. Upon this part of the work will depend in large measure the promptness and accuracy of the inventory taking. The instructions, therefore, should be as explicit as possible in regard to various classes of materials, dealing separately with raw stores, work in process, repair jobs, waste and spoiled materials, and any other materials calling for special mention. Moreover, as previously stated, this clean-up is one of the principal objectives of the inventory taking.

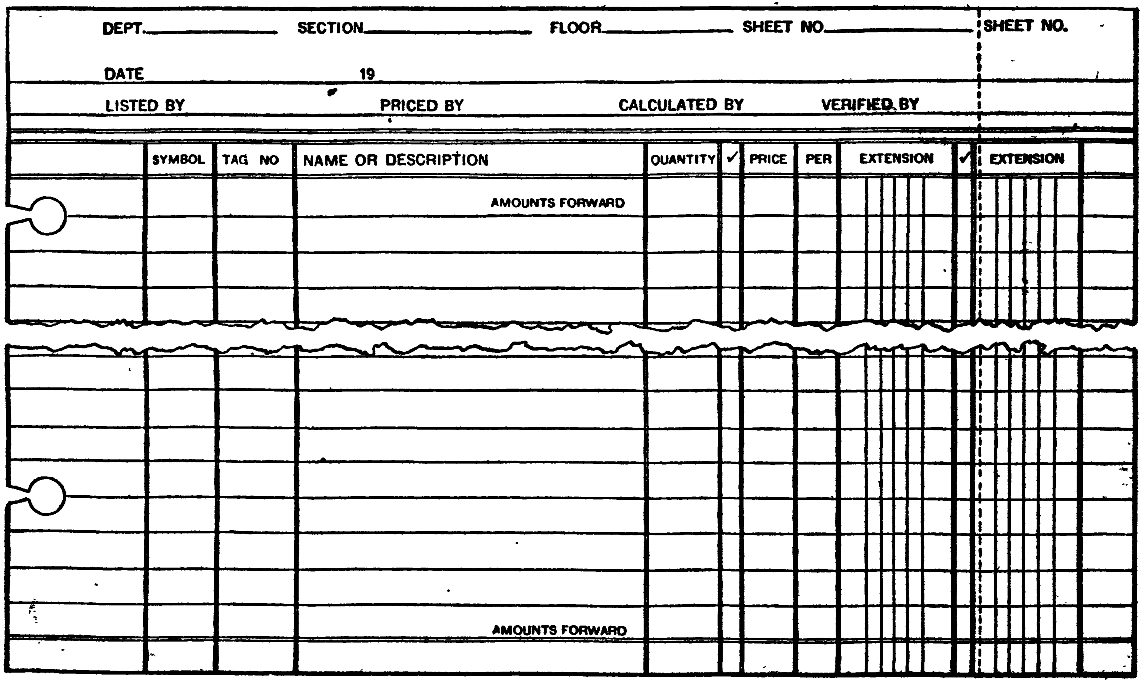
Taking the Inventory

The inventory taking procedure usually consists of attaching a tag to every lot or item, all information on the tag being filled in at the same time, except the count. A second person follows who makes the actual count and enters it. The accuracy and speed of this part of the work will be greatly helped if the materials have previously been well arranged. Frequently duplicate or coupon tags are used, to enable a check-up to be made and to make sure that items missed on the first count will be taken on the second, but without duplication. When a third person has been around to see that all materials have been tagged and counted, the tags are pulled and then collated and summarized on sheets similar to that shown in Form 18.

On this form the extensions are first computed and entered in the extreme right-hand column, which is then torn off. The extensions are made a second time by a different person and entered in the other extension column; the two computations are then matched and all divergences reconciled.

In some cases, work is saved by providing a space on the tag itself for the extension. The tags may then be summarized on adding machines without transferring them to sheets.

When the inventory is not a very complicated one, a single tag may be used with satisfactory results. If, however,



DEPT.______ SECTION______ FLOOR______ SHEET NO.______ SHEET NO.

DATE 19

LISTED BY PRICED BY CALCULATED BY VERIFIED BY

	SYMBOL	TAG NO	NAME OR DESCRIPTION	QUANTITY	✓	PRICE	PER	EXTENSION	✓	EXTENSION	
			AMOUNTS FORWARD								
			AMOUNTS FORWARD								

Form 18: A form for inventory summary.

the inventory is troublesome to handle, or if for any reason the management desires to check it carefully, a duplicate tag may be found necessary. In one case, with the double tag used, the first count was entered on the main part of the tags, which were gathered up and turned into the office. The other part of the tag was then filled in by another person and likewise sent to the office. In both cases the tags were kept in the same numerical sequence so that it was easy to compare the two parts of the same tag. All substantial discrepancies were referred back to the stores department for reconciliation. On an inventory of 20,000 items it was found that 600 tags needed this verification and amendment.

Value of the Inventory

The pricing of the items, of course, is office work. It may be done by the aid of the perpetual inventory record if prices are entered there; otherwise reference must be made to price lists and invoices. The resulting inventory is thus valued at cost; wherever the current market price is lower, a notation should be made and the extension computed at that price also. The sum of these differences should be ascertained, and this total is the amount to be used for writing down the inventory to current market whenever that price shall be less than actual cost. This is the significance of the "cost or market, whichever is lower" basis of valuing inventories; it means that, if the goods could be replaced at a lower cost, the loss should be taken; but if the market price has gone up, it is not deemed wise to take that profit until the goods are actually sold. This policy is sometimes attacked as being inconsistent, but it has in practice proved itself to be a pretty sound and reliable procedure. The only serious departure from it would arise where a loss in realizing the inventory was anticipated, though the prices had not yet actually fallen; such an expected loss should be indicated by marking down the inventory to what it was reasonably hoped to get for it.

The Form of Inventory Record

There are three principal varieties of perpetual inventory record, namely, the loose-leaf record, the vertical card index style, and the flat "visible" index; a selection among these must depend on the circumstances of the case. A loose-leaf record has advantages if it is desired to keep a good deal of information upon a relatively small number of different items; a few large sheets may then suffice for the record, and they can be put up in a loose-leaf binder. The vertical card index is probably the form in most common use; it is simple to handle, economical of space, and flexible for a large number of cards. The visible index flat record is more expensive as regards the necessary equipment and the space it requires, but it probably affords the most effective and up-to-date control, since it leaves the name and symbol of every part visible, it lies in form for easy reference, and it lends itself to the use of a variety of signals to indicate such notices as "time to reorder," "obsolete stock," "overstocked," and so on. When the inventory runs to considerable value per item and a large number of items, it is probable that such a record is economical in the control it effects.

In some cases, especially where stores are scattered about in several locations, it is found desirable to keep two inventory records. One is kept in the stores record department and is subdivided into sections corresponding to the different store houses; this record is kept in quantities only and its principal use is to help the physical management of the inventory itself. The other record is kept in the cost department and records both quantities and value; its use is to supply cost-accounting information and also to tie in with the financial records. It is necessary to make constant checks between the two inventory records to keep them in agreement; but where this is done a high degree of accuracy may be obtained. In one case where this practice was followed the inventory record was kept with almost complete accuracy, the percentage of error being 0.05 of 1 per cent.

Standardization

The movement for reducing the number of different designs and sizes has a close bearing upon inventory records, where the latter is used for an active control of the physical stock. Within the last few years some astonishing results have been achieved in the way of reducing the number of different items kept in stock, by eliminating duplications and small variations. Thus the Chesapeake and Ohio Railroad, between 1921 and 1927, reduced its inventories 60 per cent in value, and by 22,000 items, by means of a thoroughgoing scrutiny of all articles entering into the inventory.[1] Similar results have been achieved by other industrial companies, and the resultant savings are obviously large.

The inventory record should aid greatly in work of this sort. When, for example, code numbers or symbols are being devised for the different articles, those items which have only slight differences are brought to attention because of the difficulty of coding them. The inventory record will also commonly make note of all the specific uses to which the article is put; this facilitates the elimination of items for which another article will serve just as well.

Other Means of Inventory Reduction

Apart from the question of eliminating unnecessary sizes and designs, the problem of inventory reduction is a question of adapting the supply of materials on hand to production requirements, and these in turn are controlled by sales. The ideal would be to have no raw materials inventory—to have materials proceed direct from the receiving floor into process and from the shipping room to customers. This is a practical impossibility in most cases, but the nearer it can be approximated the more satisfactory the results.

With this in mind a program should be worked out starting with sales and the quantities to be delivered from week to week. By deducting the time necessary for transportation and holding in stock if necessary, the dates when these products must emerge from the factory are determined. By deducting the time necessary for assembly and manufacture of the various parts, the time when these parts must be put into process is ascertained. The business of the inventory of raw stores and partly finished goods is simply to be on hand at the time when this processing is scheduled to commence. By paying close attention to the matter the time necessary for delays and margins of safety can be greatly curtailed, and all reductions in time, of either manufacturing or procurement, mean reductions in the inventory.

This constant attention to the elimination of unnecessary items and unnecessary delays in providing them will annually produce a considerable quantity of obsolete and superseded materials. It is sometimes found necessary to employ men specially to follow these up with a view to seeing that they are disposed of to advantage. Sometimes this work is of so much importance that a committee of factory officials is formed to attend to it.

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[1] *Railway Age*, March 12 and 19, 1927.

Cost of the Inventory Record

The foregoing paragraphs on the constructive uses of a book inventory have been given in part because some business men object to an inventory record on the score of cost. If it is merely a recording procedure, this objection is likely to be valid; but if the record is used as the basis of an active campaign for reducing the inventory and making it more serviceable, the cost of keeping the record is likely to be saved many times over.

No figures are available to show what this clerical cost is in the majority of cases. In one factory of a machine-shop type, making one product in very few sizes, the cost per annum of the clerical assistance for keeping the record amounted to 0.06 per cent of the average value of the inventory. In another case, a plant making one type of product in considerable variety spent 0.35 per cent on its inventory control system; a third plant making a variety of products, each in many sizes and designs, spent 0.68 per cent. All these cases were in England.[1] An American firm of the same general type spent 0.15 of 1 per cent for clerical help in keeping an inventory of 15,000 cards, of which 12,000 were active; the inventory was kept by quantities and by values, and two reports were prepared every month. In this case two items constituted about 75 per cent of the entire inventory; if these were subtracted the clerical expense would amount to 0.60 per cent of the value of the remaining inventory handled. This doubtless largely explains the wide discrepancy between the English figures cited above; an inventory in which a few items run to very large figures can be handled at a much lower percentage of clerical cost than an inventory of the same value but of greater variety in content.

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[1] *The Cost Accountant*, March, 1927, p. 301.

Questions and Problems

1. Construct a form for a perpetual inventory record; on this form enter the following information about sulphite pulp, a material used by the Mallory Paper Company in the manufacture of high-grade paper. In the stores it is coded as D28.6. The standard price is 6¢ per pound; the minimum quantity is 25,000 lb., and the quantity to order is 15,000 lb.

Jan. 1, 1929. At the opening of the record the quantity on hand is 33,000 lb., valued at 5.9¢ per pound, or $1,947.00 total. The quantity available is the same.

Orders are scheduled as follows:

Jan. 3	Furnish Order 378, Scheduled to run Jan. 8..........	5,000 lb.
7	Furnish Order 379, Scheduled to run Jan. 12..........	4,000 lb.
11	Furnish Order 380, Scheduled to run Jan. 16..........	16,000 lb.
29	Furnish Order 381, Scheduled to run Feb. 3..........	8,000 lb.

Each time the stores available became less than the minimum, a new lot was ordered on the following day. The material was regularly received 10 days after being ordered and was considered available as soon as ordered, since the minimum quantity was considered ample to provide for the intervening time. The order placed on January 8 was No. M 379, the price per pound being 6¢; the order placed on January 12 was No. M 402, and the price per pound was 6.1¢.

Show the inventory card as it appeared on January 31.

2. During January, 1929, a manufacturing company received check reports from its storeskeeper, the totals of which showed the following facts:

Date	Items verified	Differences in amount between actual count and inventory record	
		Gain	Loss
Jan. 5	20	$36.94	
7	24	40.85	
9	20		$13.76
13	24	18.60	
16	20	9.57	
19	20	6.88	
22	25		16.64
25	24	13.25	
27	20		9.17
31	24	34.16	

What adjustment should be made at the end of the month to bring the records into agreement with the facts? How would you comment on the foregoing check record?

3. If a company keeps a perpetual inventory record, which is likely to be more reliable, the record or an inventory based on physical count?

Explain. Under such circumstances, what object can there be in taking a physical inventory?

4. What is meant by "economy in inventory"? Why is it important, and how may it be secured?

5. A paper manufacturing company followed the practice of charging to Work in Process entire kegs of coloring matter when they were first sent from the stores, although the contents of these were used only gradually in small quantities. The following table shows in columns (*a*) and (*b*) the quantities and value of materials so charged to process, and in column (*c*) the quantities actually used during each month; an investigation was made which yielded the last-named figures. There are also given the inventories at the beginning and end of this period.

	(*a*) Quantities charged, kegs (150 lb.)	(*b*) Value	(*c*) Quantities used, pounds
Jan. 31	36	$ 435.00	7,500
Feb. 28	30	362.50	3,700
Mar. 31	40	490.00	7,000
Apr. 30	28	340.00	2,400
		$1,627.50	20,600

INVENTORIES PARTLY USED

Date	Kegs, all partly used	Pounds	Value
Jan. 1	45	2,700	$290
Apr. 30	48	3,200	$245

a. Prepare a statement to show the monthly differences between charging to Work in Process what was actually used as compared with what was sent into the department.

b. Do you think it necessary to change the method?

6*a*. Prepare journal entries for the following transactions relating to the use of containers by a chemical company.

Mar. 2. Bought 2,000 tight barrels @ $3.00
17. Bought 1,000 tight barrels @ $2.90
28. Bought 3,000 tight barrels @ $3.10
29. Bought 200 tight barrels @ $2.00

All of these purchases were on account.

March 31. Total sales for the month $29,500. There was also charged to customers $12,000, being 3,000 barrels at $4 each.

March 31. Cash was received from customers during the month amounting to $33,500.

Cash paid on account during the month $20,000.

March 31. During the month 1,400 barrels were received back from customers; of these, 800 were paid for in cash at the amount originally charged for them, and the remaining 600 were allowed as credits on customers' accounts at the same rate.

March 31. It was decided to write off 200 tight barrels, which it was expected would never be returned by customers.

March 31. Depreciation for the month was recorded on tight barrels. The amount was computed on the balance of the account as it now stood, on the basis that the barrels would last for three years.

b. Post the foregoing entries to ledger accounts.

7. A company which had been preparing monthly profit and loss statements by the "gross profit method" showed a statement for six months, prepared on that basis, as follows:

PROFIT AND LOSS STATEMENT, SIX MONTHS ENDING DECEMBER 31, 1931

Sales of Finished Products		$504,000
Sales, Miscellaneous		16,000
		$520,000
Cost of Finished Products Sold (70% of sales value)		352,800
Gross Profit on Sales		$167,200
Less: Selling Expenses	$25,000	
Advertising and Sales Promotion	46,000	
Administrative Expenses	54,000	
Bond Interest	5,000	130,000
Net Profit for Period		$ 37,200

The ledger trial balance on December 31, 1931 was as follows:

Machinery and Equipment	$ 167,000	
Land and Buildings	233,000	
Reserve for Depreciation		$ 86,000
Inventories, Raw Materials, July 1, 1931	56,000	
Work in Process, July 1, 1931	94,000	
Finished Goods, July 1, 1931	63,000	
Accounts Receivable	102,000	
Cash	81,000	
Accounts Payable		93,000
Sales, Finished Products		504,000
Miscellaneous		16,000
Purchases, Raw Materials	141,000	
Direct Labor	154,000	
Manufacturing Expenses	73,000	
Selling Expenses	25,000	
Advertising and Sales Promotion	46,000	
Administrative Expense	54,000	
Bond Interest	5,000	
Funded Debt		200,000
Capital		300,000
Surplus		95,000
	$1,294,000	$1,294,000

When physical inventories were taken on December 31, 1931, they were found to be:

Raw Materials	$61,000
Work in Process	79,000
Finished Goods	77,000

Prepare:

a. A balance sheet as of December 31, 1931.

b. A profit and loss statement for six months ending December 31, 1931.

c. A statement to reconcile the net profit shown in your statement prepared for *b* and the net profit of $37,200 shown in the foregoing profit and loss statement.

d. Under what conditions would profit and loss statements prepared by the "gross profit method" prove unsatisfactory?

8. Outline a form which could be used conveniently for taking an inventory of work in process, in a factory where a complete system of order costs was in effect, so that there was a cost sheet for each manufacturing order, the sheets being kept up to date by frequent postings. Explain how your form would be used, and what modifications, if any, would be necessary in the values thus found.

9. What relation does inventory control bear to production, sales, finance, and profits?

10. What instruction should be given to employees prior to the taking of a physical inventory?

11. Upon what factors should the determination of inventory quantities be based?

12. What are the advantages and disadvantages of perpetual inventory records?

13. Assuming that a company is operating a perpetual inventory system, would an actual count of each item at the time the order point was reached suffice for physical inventory purposes?

14. The Harbord Manufacturing Company's directors desired to have monthly operating statements supplied to them in the following condensed form:

OPERATING STATEMENT

	This month (give date)	Year to date (give date)
Net Sales		
Less: Cost of Goods Sold:		
Raw Materials Used		
Labor		
Manufacturing Expenses		
Total		
Add: Inventories in Process and Finished—Beginning		
Total		
Less: Inventories in Process and Finished—Closing		
Total Cost of Goods Sold		
Gross Operating Profit		
Less: Selling Expenses		
Administrative Expenses		
Balance		
Loss or Gain on Inventory Adjustment		
Net Operating Profit		
Add: Other Income		
Net Profit of Period		

The books of the company were closed only once a year, on March 31.

The company's trial balances showed the following figures for the dates given:

	Apr. 30, 1931		May 31, 1931	
Cash on Hand	500		500	
Cash in Bank	72,000		78,500	
Accounts Receivable	125,500		132,000	
Notes Receivable	40,000		45,000	
Raw Material Inventories, Apr. 1, 1931	85,000		85,000	
Work in Process Inventories, Apr. 1, 1931	57,000		57,000	
Finished Goods Inventories, Apr. 1, 1931	41,000		41,000	
Investments	100,000		100,000	
Land	139,000		139,000	
Buildings	260,000		260,000	
Plant and Equipment	310,000		320,000	
Reserve for Depreciation		205,000		208,500
Prepaid Insurance	4,000		3,000	
Accounts Payable		35,000		38,000
Accrued Wages		1,000		1,500
Capital Stock, Common		700,000		700,000
Surplus, Apr. 1, 1931		334,800		334,800
Sales		138,500		303,600
Sales Returns and Allowances	2,000		3,500	
Sales Discounts	1,500		2,500	
Raw Materials Purchased	114,300		187,400	
Direct Labor	20,000		45,000	
Supplies	7,000		13,500	
Indirect Labor	2,000		4,500	
Heat, Light, and Power	1,000		2,000	
Taxes, Insurance, and Depreciation	5,000		10,000	
Advertising	9,000		19,000	
Salesmen's Salaries	6,000		12,000	
Other Selling Expenses	3,000		6,000	
Administrative Salaries	4,000		8,000	
Administrative Expenses	6,000		13,000	
Other Income		500		1,000
	$1,414,800	$1,414,800	$1,587,400	$1,587,400

The various inventories were as follows on the dates shown:

	Apr. 30, 1931		May 31, 1931	
	Cost	Market	Cost	Market
Raw Materials	$114,300	$110,800	$102,900	$ 97,000
Work in Process	60,000	58,000	59,000	55,000
Finished Goods	43,500	41,500	42,500	38,500
	$217,800	$210,300	$204,400	$190,500

***a.* Prepare the operating statement in the condensed form given.**

***b.* Prepare a classified balance sheet as of May 31, 1931.**

***c.* Express your opinion of the merits or faults of the form of operating statement.**

VIII

LABOR COSTS

Essentials of Labor Relations

One of the most important elements in the success of a manufacturing enterprise is a satisfactory relationship between employees and the management; the principal factor in such a relationship is the wage system upon which the employees are paid, meaning by "wage system" both the basis of its computation and the scale itself. A satisfactory wage system, broadly speaking, is one which will give the employees the feeling that they are receiving fair remuneration for the work they do, and which will at the same time give the management the desired output at a satisfactory cost. An immense amount of experimenting has been done with a view to finding the ideal wage system; while one system is more suitable than others in a given case, there is no one system that is universally satisfactory. Some discussion concerning the various wage systems will be found in the next chapter. The elements which are universally present in all systems which work well are fairness and intelligence on the part of the management. Fairness alone will not do it; there must also be intelligence not only in demonstrating fairness but in so planning and ordering the work that employees are helped in giving a good account of themselves and in earning a good rate of pay. The responsibility for finding out how to employ workmen profitably is upon employers. In this respect competition among employers for obtaining labor has some very beneficial aspects from the point of view of general society; it tends to place labor in the employ of those who can use it best, can make it most productive, and can therefore pay the highest wages for it.

The Cost Department and Labor

The duties of the cost department with regard to labor costs are undertaken for two principal purposes. Records must be kept which will assemble the payroll, showing what each man has earned during the payroll period. On account of the absolute necessity of having the payroll ready at the time of paying off the men, this work of computing the earnings of individual employees usually takes precedence over other work connected with recording labor costs. The latter procedure consists of distributing the total payroll so that each department, process, or individual job will receive its proper charge.

Two principal factors will help to govern the precise method of gathering the labor cost records. One is the general cost system, whether it gathers costs by the job or by the process, and the other is the particular wage system in operation.

Day Work and Process Costs

Probably the simplest situation, and one very commonly found, is that in which the men are paid on a day work basis, and costs are gathered on a process or departmental basis. Such a situation would probably be found in a chemical plant or in a tannery. In these conditions it is necessary only to find some simple method of recording the times when the men enter and leave the works; a time clock and a system of brass checks are the common examples. The compilation of the payroll in such cases requires only the addition of the various hours of work, the total to be multiplied by the proper hourly or daily rate. The cost accounting side is taken care of by distributing the payroll among the various departments or processes in which the men have worked. It frequently happens, however, that the men do not work continuously on the same process; it may even happen that they will be paid different rates when doing different tasks. In either or both of these cases, it is necessary for the record to state precisely what processes were worked on, and how much time was spent on each.

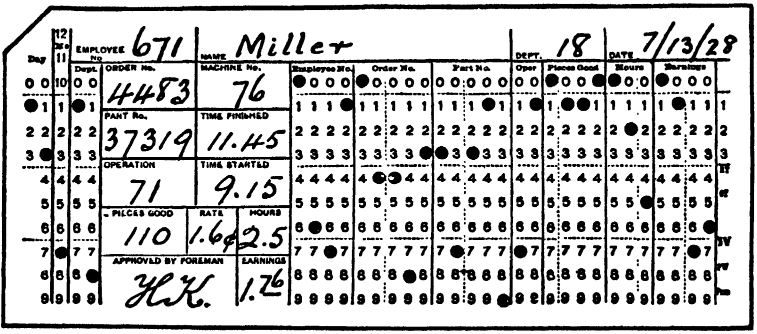
Hourly Rates and Job Costs

Another case is that where the men are paid an hourly rate, with guaranteed full-time work, but where it is desired to allocate the labor costs to individual jobs. Such a situation is found in the average printing establishment. Under these conditions it is common to have one slip for each man each day, the slip covering the whole day by hours and tenths of hours. By simply scoring under the starting and stopping times for individual jobs and writing in the job numbers, the workman may indicate on this sheet to what jobs his time is to be charged. If no work is on hand for him for part of the day, that period will bear no job number and will be classed as nonchargeable time. One of the most important facts in such a plant is found in the percentages of nonchargeable and chargeable time to the total.

The use of one slip per man per day is not by any means universal in the printing industry; a number of firms use a ticket for each job and each man, as described in the next paragraph.

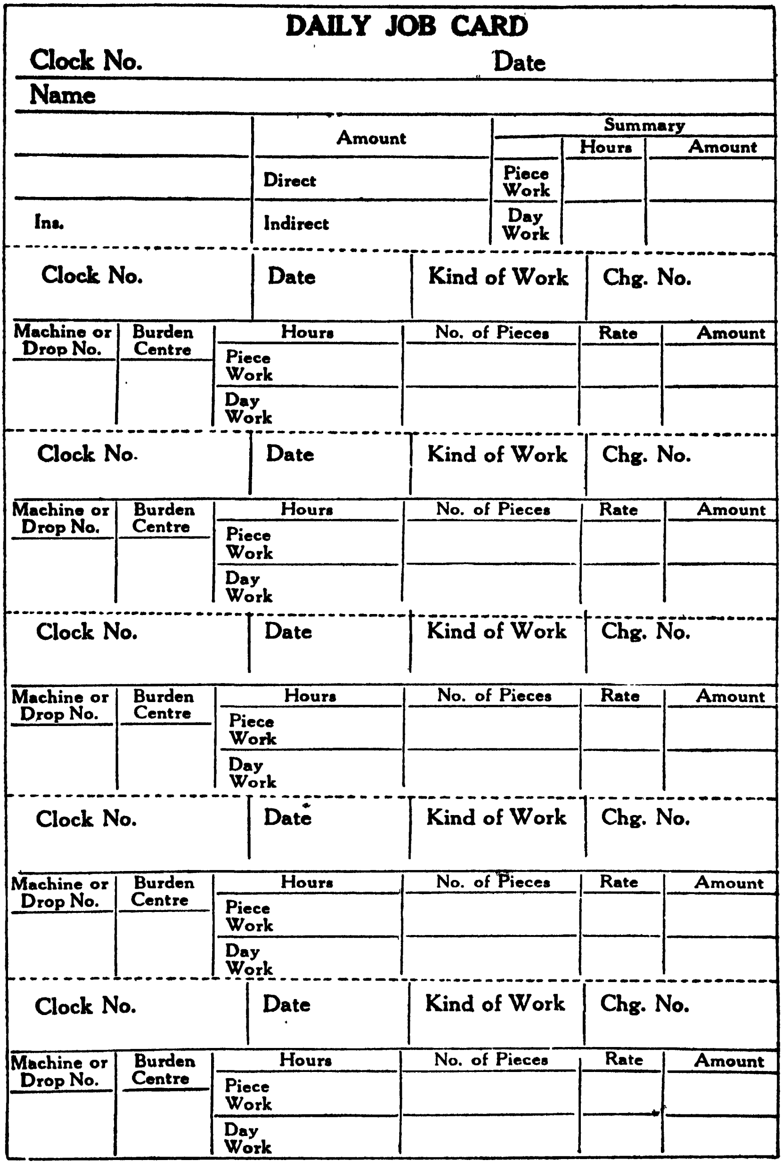
Piece Rates and Job Costs

When the workmen are paid only for the time they actually work, and especially when they are paid on a piece-rate basis, it is more usual to provide one job ticket or work ticket for each job; such a ticket records one man's time on one job. It must indicate the quantity of work done and usually will provide space to show that the work has been inspected and found good, that being an important accompaniment of any piece rate system. Form 19 above, shows a card which performs this service, as used in conjunction with a tabulating machine. When these cards have been properly filled in, they are sorted, first to gather together all the cards for each employee, thus giving the payroll, and next to assemble all the cards relating to any one job or lot, thus giving the labor cost to be charged to that job. On account of the facility with which


Employee No 671
Name Miller
Dept. 18
Date 7/13/28
Order No. 4483
Machine No. 76
Part No. 37319
Time Finished 11.45
Operation 71
Time Started 9.15
Pieces Good 110
Rate 1.6¢
Hours 2.5
Approved by Foreman H.K.
Earnings 1.76

Day
Dept.
Employee No.
Order No.
Part No.
Oper.
Pieces Good
Hours
Earnings

Form 19: A job ticket, for use with a tabulating machine.



DAILY JOB CARD

Clock No. **Date**

Name

	Amount		Summary	
			Hours	Amount
	Direct	Piece Work		
Ins.	Indirect	Day Work		

Clock No.	Date	Kind of Work	Chg. No.

Machine or Drop No.	Burden Centre	Hours	No. of Pieces	Rate	Amount
		Piece Work			
		Day Work			

Clock No.	Date	Kind of Work	Chg. No.

Machine or Drop No.	Burden Centre	Hours	No. of Pieces	Rate	Amount
		Piece Work			
		Day Work			

Clock No.	Date	Kind of Work	Chg. No.

Machine or Drop No.	Burden Centre	Hours	No. of Pieces	Rate	Amount
		Piece Work			
		Day Work			

Clock No.	Date	Kind of Work	Chg. No.

Machine or Drop No.	Burden Centre	Hours	No. of Pieces	Rate	Amount
		Piece Work			
		Day Work			

Clock No.	Date	Kind of Work	Chg. No.

Machine or Drop No.	Burden Centre	Hours	No. of Pieces	Rate	Amount
		Piece Work			
		Day Work			

Form 20: Coupon form of job card.

they may be thus distributed and redistributed, this basic system of having one ticket per man per job is very widely used; the tickets themselves are found in very different forms, depending especially on the mechanical devices which are used first to record them and next to assemble them in various ways.

It frequently happens that the overhead or burden is to be distributed in proportion to labor, by either a rate per labor hour or a percentage of the labor cost. In all such cases the job tickets should provide space for the computation of the burden charge to be made for that particular work.

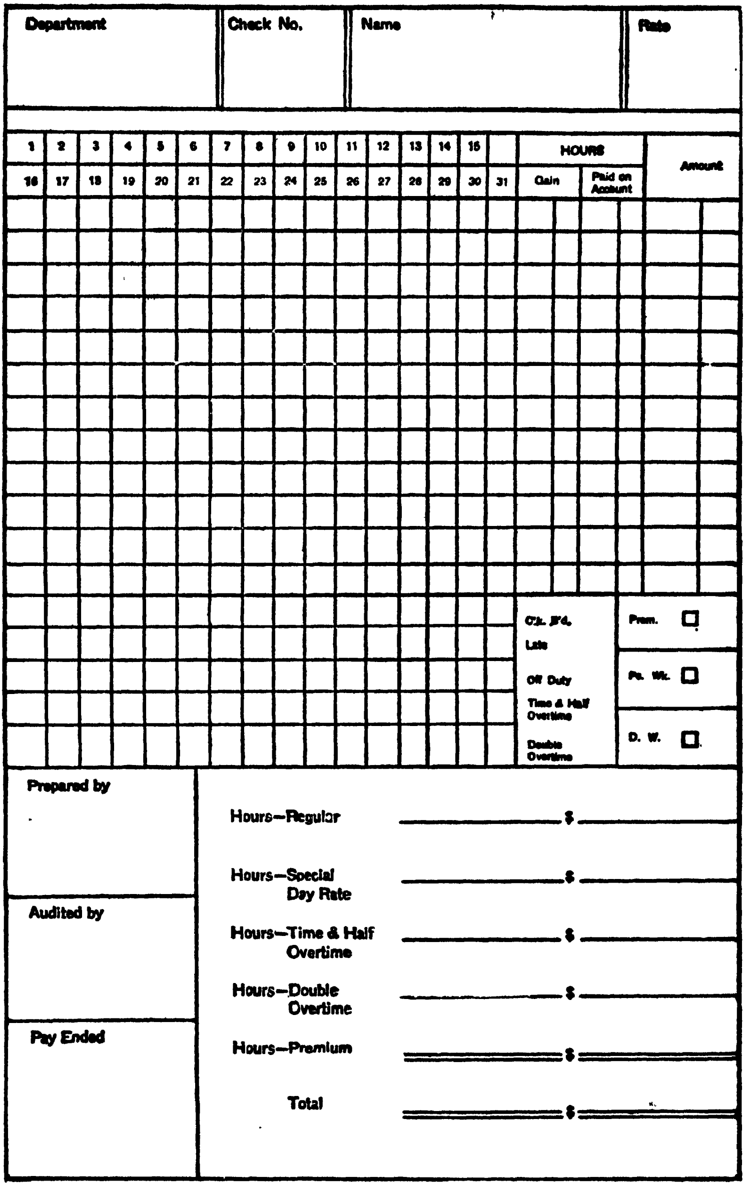
Daily Job Card—Coupon Form

Form 20 is another variety of primary labor record. It is a card for one man for one day, designed for use where the work consists of series of operations on parts, and where a man may work on several operations, or on several lots, in one day. As each lot is completed, a coupon is filled out for it, torn off the main card, and turned in to the cost department. It will be seen that each coupon provides spaces for the man's clock number, for the amount of work done, the rate of pay, and the amount due the operator for that lot. The burden center is also inserted so that the correct burden rate may be applied. These coupons are afterwards summarized by man and by the account number to be charged.

Payroll Assembly

Form 21, on page 117, illustrates a simple type of sheet on which the amount of wages to be paid to each employee is assembled for each payroll period; the form is used in the works of a large electrical manufacturing corporation where various types of wage payment are in operation.

Form 22, on page 118, shows how the other important operation may be accomplished, namely, the distribution of wages earned to the proper jobs or product. This form is unnecessary if individual job tickets are used and are summarized on an adding or tabulating machine. Form 21 and Form 22 both apply to an individual man; the former provides for accumulating his time for the payroll period; the latter divides that time according to the different jobs to which it must be charged.



Department	Check No.	Name	Rate

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		HOURS		Amount
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Gain	Paid on Account	

Ck. Fd.
Late
Off Duty
Time & Half Overtime
Double Overtime

Prem. ☐
Pc. Wk. ☐
D. W. ☐

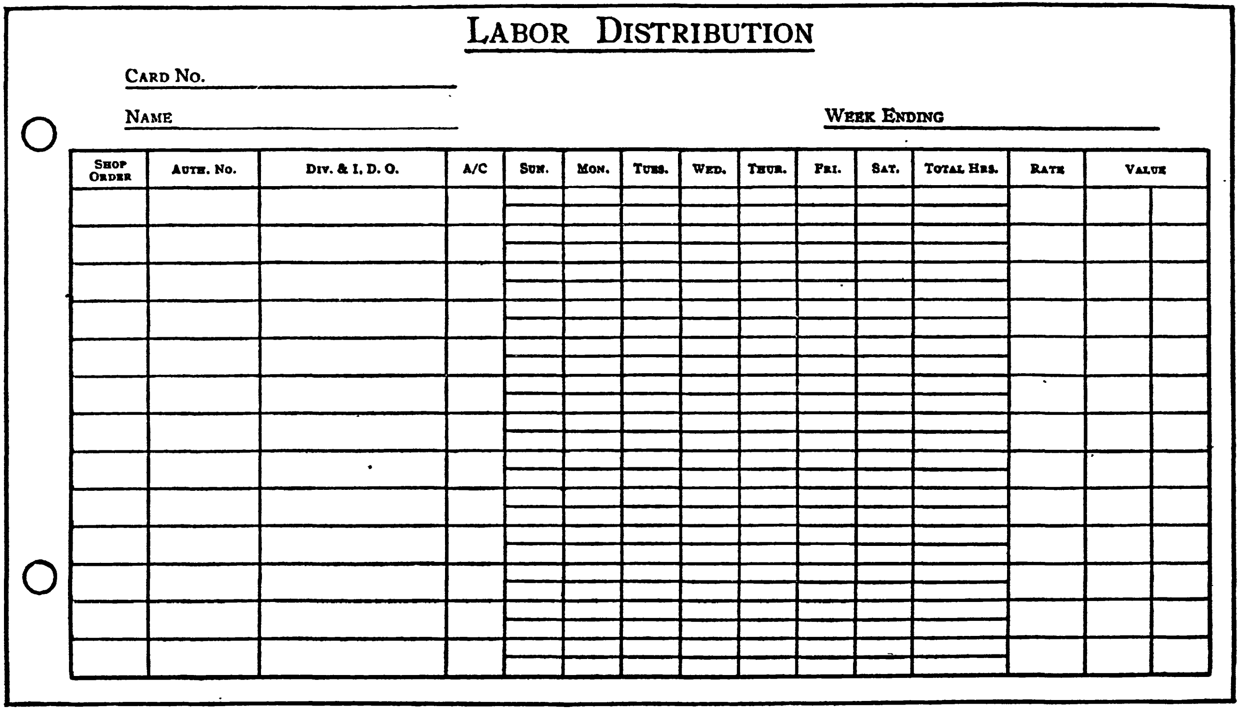
Prepared by

Audited by

Pay Ended

Hours—Regular ____________ $ ____________
Hours—Special Day Rate ____________ $ ____________
Hours—Time & Half Overtime ____________ $ ____________
Hours—Double Overtime ____________ $ ____________
Hours—Premium ____________ $ ____________
Total ____________ $ ____________

Form 21: A form for finding the earnings of one man.



LABOR DISTRIBUTION

CARD NO. ____________________

NAME ____________________ WEEK ENDING ____________________

SHOP ORDER	AUTH. NO.	DIV. & I. D. O.	A/C	SUN.	MON.	TUES.	WED.	THUR.	FRI.	SAT.	TOTAL HRS.	RATE	VALUE	

Form 22: A form for distributing the wages of one man to jobs.

Protecting the Payroll Work

The following may be taken as typical of the practice of a well-managed company in providing safeguards against payroll frauds. The company recorded labor costs on punched cards.

The company paid all employees by check, the checks also being on cards of shape and size suitable for punching, and with spaces for punching employee number, gross earnings, and net amount. The next stage, therefore, was to prepare these checks, the name and employee number being inserted by addressograph, and the amount by a Todd check writer, copying from the payroll list. The punching was then made and the checks run through the tabulator in order to compare the total with the payroll total. The cashier then put the company's facsimile signature on all these checks by addressograph, and the checks were ready for the paymaster by Friday morning.

A number of provisions were adopted as security against mishandling of the payroll. First, no paymaster had anything to do with the preparation of the payroll. Second, when once the checks had been written, no payroll department man could touch them. Third, 10 paymasters were employed, these being clerks who also worked on various other jobs. The routes of these paymasters were changed every week, and they never knew in advance to what group of employees they were to distribute checks.

Distribution of Payroll to Costs

In the analysis of the entire payroll, the first distinction to be made is between direct and indirect labor. Direct labor is that which is employed directly on productive work; it can therefore be allocated as a direct cost to that productive work. Indirect labor, on the contrary, includes all that labor which is employed in contributory services. Such labor should in the aggregate increase the total production or contribute to orderly and economical production, otherwise its employment is not justified. Indirect labor includes the work of clerical help, supervisory staff, power station crew, floor sweepers, janitors, and so forth. Whenever these workers are engaged within one department, their wages should be charged directly as overhead of those departments. Frequently, however, indirect labor includes items pertaining to many departments, in which case it must be prorated on some fair basis to the departments which benefit.

The terms productive and nonproductive are sometimes used with the same meaning given above to the terms direct and indirect; but if these employees contribute indirectly to increase production, it is hardly a correct description to call them nonproductive. Moreover, some indirect labor is actually employed upon an immediate product, but not on a product made for sale. The employees of a repairs and maintenance department, for example, are directly engaged on machine work, and so forth; but the product of their labor is not sold; it goes only to facilitate the production of goods for sale. Such a department is accordingly regarded as an indirect department, and its expenses will be charged where its services are given.

Another problem arises when workers are transferred from one department to another, as needed. Their time should be charged to the department and product on which they work, not to the department in which they may be originally registered.

Distribution of Labor to Products

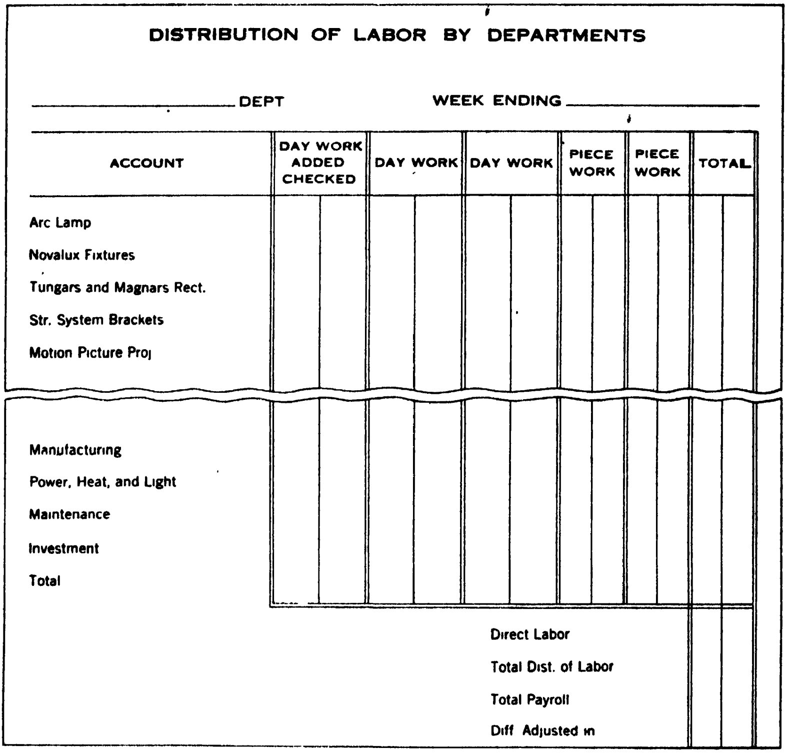
Form 23 is used by an electrical manufacturer for the purpose of allocating labor costs to the different products made. One such sheet is prepared weekly for each department of the plant. The products down the left side are the same on all the departmental sheets in any one plant, as there might be charges to the same product from several departments.

In addition to the products made for sale, the indirect and plant accounts are also listed down the left side. Accounts are shown for Power, Heat, and Light, for Maintenance, and for Investment or Plant account, so that provision is made for the entire payroll, which is totaled at the bottom, where space is also provided for any small adjustments which may be necessary in the distribution.

Other Labor Records

The government now requires that manufacturers furnish to the income tax department a statement of the annual earnings of the employees. This necessitates an accumulating record which probably would not be kept if it were not for this legal requirement. Many firms, however, have made good use of this record in dealing with labor matters. The record indicates whether a man's earnings are, in the long run, very much out of line and prompts inquiry into the causes of irregularities.

In addition to the accounting record, it is common in all except small businesses to keep an employment record which indicates the principal facts about the employee and the chief incidents in his career. Such a record is a valuable help in labor administration.



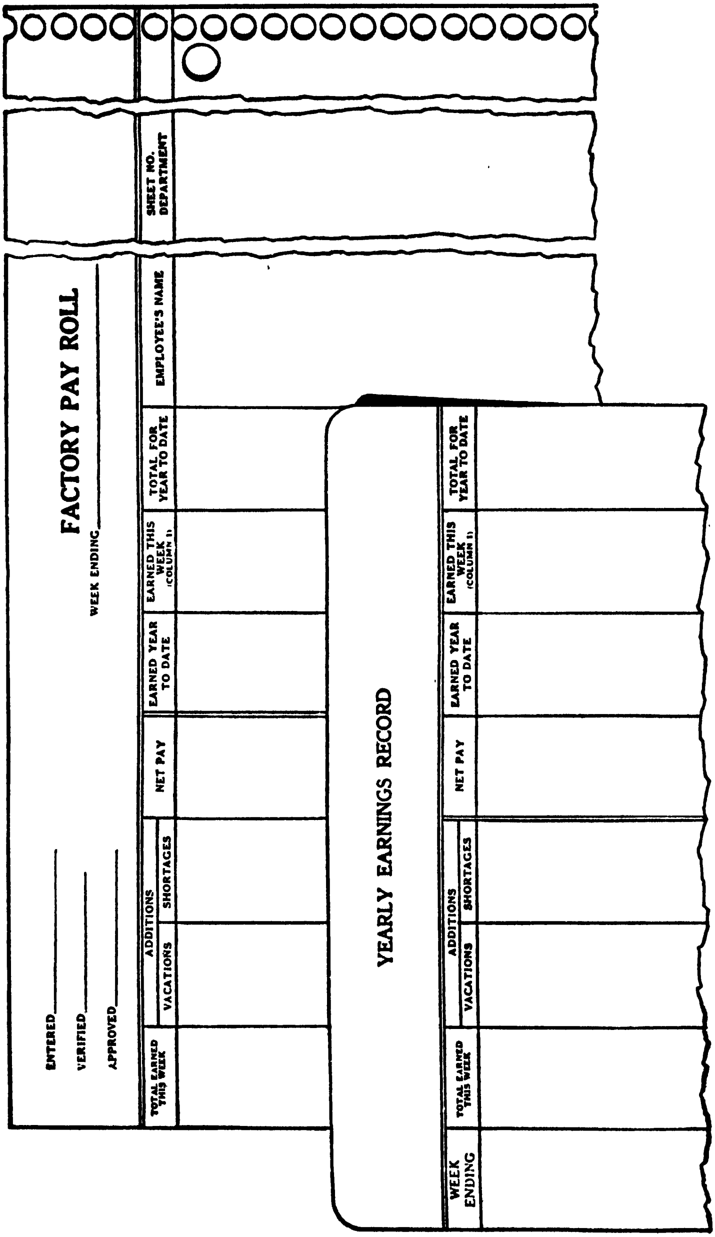
DISTRIBUTION OF LABOR BY DEPARTMENTS

______ DEPT WEEK ENDING ______

ACCOUNT	DAY WORK ADDED CHECKED	DAY WORK	DAY WORK	PIECE WORK	PIECE WORK	TOTAL
Arc Lamp						
Novalux Fixtures						
Tungars and Magnars Rect.						
Str. System Brackets						
Motion Picture Proj						
Manufacturing						
Power, Heat, and Light						
Maintenance						
Investment						
Total						
					Direct Labor	
					Total Dist. of Labor	
					Total Payroll	
					Diff Adjusted in	

Form 23: Distribution of department labor to products.

Form 24 is an example of such a yearly record of earnings; it shows also how the making of this record may be combined with the regular payroll. Most of the columns of the yearly earnings record are the same as those in the factory payroll. For each name entered in the latter a new yearly earnings record will be inserted in the machine so



FACTORY PAY ROLL

WEEK ENDING________

ENTERED________

VERIFIED________

APPROVED________

TOTAL EARNED THIS WEEK	ADDITIONS		NET PAY	EARNED YEAR TO DATE	EARNED THIS WEEK (COLUMN 1)	TOTAL FOR YEAR TO DATE	EMPLOYEE'S NAME	SHEET NO. DEPARTMENT
	VACATIONS	SHORTAGES						

YEARLY EARNINGS RECORD

WEEK ENDING	TOTAL EARNED THIS WEEK	ADDITIONS		NET PAY	EARNED YEAR TO DATE	EARNED THIS WEEK (COLUMN 1)	TOTAL FOR YEAR TO DATE
		VACATIONS	SHORTAGES				

Form 24: Record of yearly earnings for one man, with corresponding payroll record.

that the weekly figures for that man will be entered on both forms.

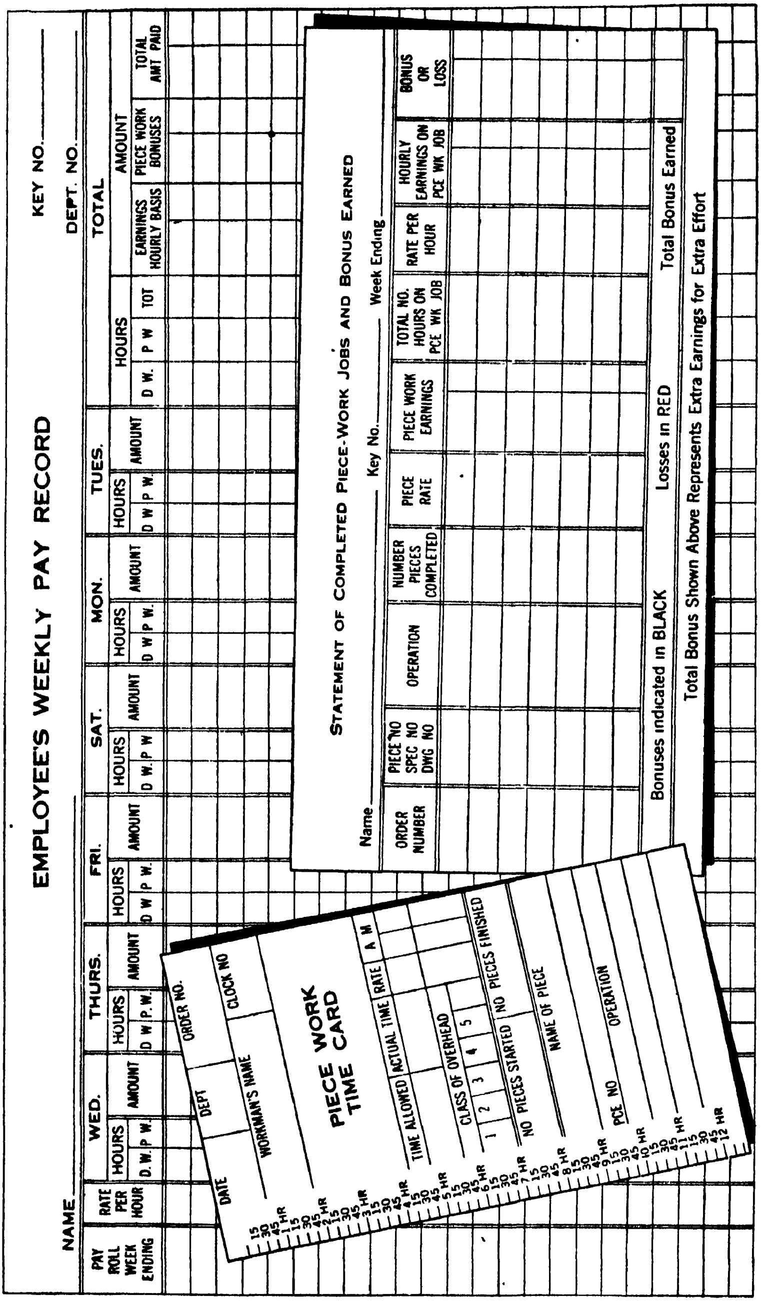
Payroll Assembly with Bonus System

Premium and bonus systems are discussed in the next chapter, but it is convenient here to refer to the problem of making up the payroll when such a system is used. Form 25 shows a series of three records used where piece work wages are paid if the employee reaches or exceeds a certain output, but a minimum hourly wage is paid if he falls below that output; in other words, his earnings are computed at piece rates and at hourly rates, and he gets whichever is the greater. The amount of his earnings in excess of the standard hourly rate is regarded as a bonus; if he fails to reach the standard, the difference between the amount paid to him at the hourly rate and the amount which he would receive at the piece rate is called a loss. The amounts of bonuses earned and losses not earned but paid to employees are separately summarized as an indication of the general labor performance.

In Form 25 the man's job ticket is a Bishop piece work time card. When jobs have been completed, they are summarized on the form entitled Statement of Completed Piece Work Jobs and Bonus Earned, which gives the total bonus earned for one week. The third form is the Employee's Weekly Pay Record; one copy of this is used for each employee and there is one line for each week, with a column for each day. In these daily columns the man's earnings are entered at straight hourly rates, but under the columns headed Total is a subcolumn for the bonuses and another for the combined total. The method of handling these forms, as regards the bonus, is further described at the end of the next chapter, and their use is again referred to in Chapter XVII.

Staggering the Payroll

In a large plant with many employees it is always a problem to get the payroll completed and the pay envelopes ready within a reasonable period after the work has been done; this is especially true where individual earnings have to be computed on piece rates or premiums. It is not uncommon for men to be paid one week or two weeks after they have



EMPLOYEE'S WEEKLY PAY RECORD

NAME ___ KEY NO. ___ DEPT. NO. ___

PAY ROLL WEEK ENDING	RATE PER HOUR	WED.			THURS.			FRI.			SAT.			MON.			TUES.			TOTAL					
		HOURS		AMOUNT	HOURS		AMOUNT	HOURS		AMOUNT	HOURS		AMOUNT	HOURS		AMOUNT	HOURS		AMOUNT	HOURS			AMOUNT		
		D.W.	P.W.		D W	P.W.		D W	P W.		D W.	P W		D W	P W.		D W	P W.		D W.	P W	TOT	EARNINGS HOURLY BASIS	PIECE WORK BONUSES	TOTAL AMT PAID

STATEMENT OF COMPLETED PIECE-WORK JOBS AND BONUS EARNED

Name ___ Key No. ___ Week Ending ___

ORDER NUMBER	PIECE NO SPEC NO DWG NO	OPERATION	NUMBER PIECES COMPLETED	PIECE RATE	PIECE WORK EARNINGS	TOTAL NO. HOURS ON PCE WK JOB	RATE PER HOUR	HOURLY EARNINGS ON PCE WK JOB	BONUS OR LOSS

Bonuses indicated in BLACK Losses in RED Total Bonus Earned

Total Bonus Shown Above Represents Extra Earnings for Extra Effort

PIECE WORK TIME CARD

DATE

DEPT

ORDER NO.

WORKMAN'S NAME

CLOCK NO

TIME ALLOWED

ACTUAL TIME

RATE

A M

CLASS OF OVERHEAD 1 2 3 4 5

NO PIECES STARTED

NO PIECES FINISHED

NAME OF PIECE

PCE NO

OPERATION

15 30 45 1 HR 15 30 45 2 HR 15 30 45 3 HR 15 30 45 4 HR 15 30 45 5 HR 15 30 45 6 HR 15 30 45 7 HR 15 30 45 8 HR 15 30 45 9 HR 15 30 45 10 HR 15 30 45 11 HR 15 30 45 12 HR

Form 25: Time card, weekly pay record, and bonus statement.

actually earned the money. One device which has been tried to help this problem is that of dividing the payroll into sections and paying a certain number of employees on one day, another group on another day, and so on, for every working day. By doing this some firms have not only reduced the period which employees have to wait for their money but have also reduced the number of clerks necessary to handle the payroll.

Variations in Direct Labor

Circumstances frequently arise in which direct labor costs are complicated by irregularities in the labor situation which affect the production of labor and the labor cost per unit. For example, the following situations may occur:

1. It is often necessary to take in learners for a period and pay them wages beyond what their output will justify.
2. When one department is not busy, the workers may be transferred to another department rather than discharged; it may be desirable to continue to pay them their old rate of wages, although in the new department they may not be able to earn them, if paid in proportion to their output.
3. The output of a department may have increased far in excess of expectations, requiring additions to the labor force, which it is impossible in a short time to bring up to the same efficiency as the old labor force, upon which perhaps a standard cost has been computed which cannot be maintained under the new conditions.

In all these cases an extra expenditure is incurred which cannot be absorbed by charging labor to the product at normal rates. How shall this unabsorbed charge be disposed of? How can these facts be most clearly expressed? In the first two cases it is probably better to charge the product for labor at the standard rate, allowing the extra expenses to be reported as a separate item of overhead, analogous to other expenses of labor administration such as the costs of an employment office. In both cases the extra expenditure is a cost of maintaining the labor force, in the first case by bringing in new labor, and in the second case by retaining present labor when there is no work for them in their own department.

The third case is somewhat different in that it reflects a situation where the direct labor force may be permanently less efficient than the smaller number of skilled workers formerly employed. If this be true, the fact should be recognized by adopting a higher direct labor cost per unit than was formerly used. In the period when the change takes place, the old standard rate should be retained so that the extra labor cost may show up as an extra loss of that year consequent upon the unexpected expansion of business. If the new workers can be brought up to the efficiency of the old workers the old standard rate may be retained and no problem will arise; but if the increased force represents a lower level of intelligence, so that an increased labor cost per unit seems likely to be permanent, then the standard labor cost should be changed so that the payroll account may be absorbed in the product.

Analytical Report on Labor

The management will in some cases be interested in a report dealing with labor performance and reflecting other factors than money costs. The following items may frequently be found in such reports:

Output in units per labor hour.
Output in units per labor dollar.
The ratio of direct to indirect labor payroll.
The average earnings per man.
Summary of bonuses earned.
Number of lates and absences by departments.
Percentage of standard production by departments.
Percentage of standard labor cost by departments.

These figures will, of course, need to be used with intelligence; the causes of variations should in all cases be ascertained before judgment is passed upon them. But in cases where labor is an important element of cost, such figures will help to give a clear impression of the situation. It must, moreover, be remembered that overhead usually corresponds pretty closely to labor performance; losses in labor mean that a longer time is taken for a given output than is necessary, and this involves losses in overhead also.

Determination of Labor Rates

The importance of determining fair rates of pay has already been emphasized. This is especially true of piece rates and of rates set under incentive systems as described in the next chapter. It is there argued, in fact, that, if piece rates are set with as much carefulness as is ordinarily used with rates under a bonus system, the piece rates are likely in many cases, though not all, to give as much satisfaction as the bonus system. Form 26 is an example of the minutely detailed studies which some companies make as a basis for fixing piece rates. Under Operation, on the front of the form, are spaces for listing every phase of the work; the Instruction Card at the foot gives full particulars about the operation. In the margin on the right are listed, under Job Analysis, all the disadvantages for which allowances should be made, below which are the Computations leading directly to the piece rate. This section on Computations is really a synopsis of the whole sheet, since it contains in condensed form all the elements entering into the rate. From the 60-min. hour two allowances are made, the first for difficulties and disadvantages attaching to the work, and the second for fatigue and similar personal allowances. The average production per hour is thus obtained, since in the meantime the standard time per unit of product has been divided into the time available. This production per hour is then converted into a production in pieces per day, which, when divided into a daily base rate, gives the desired piece rate.

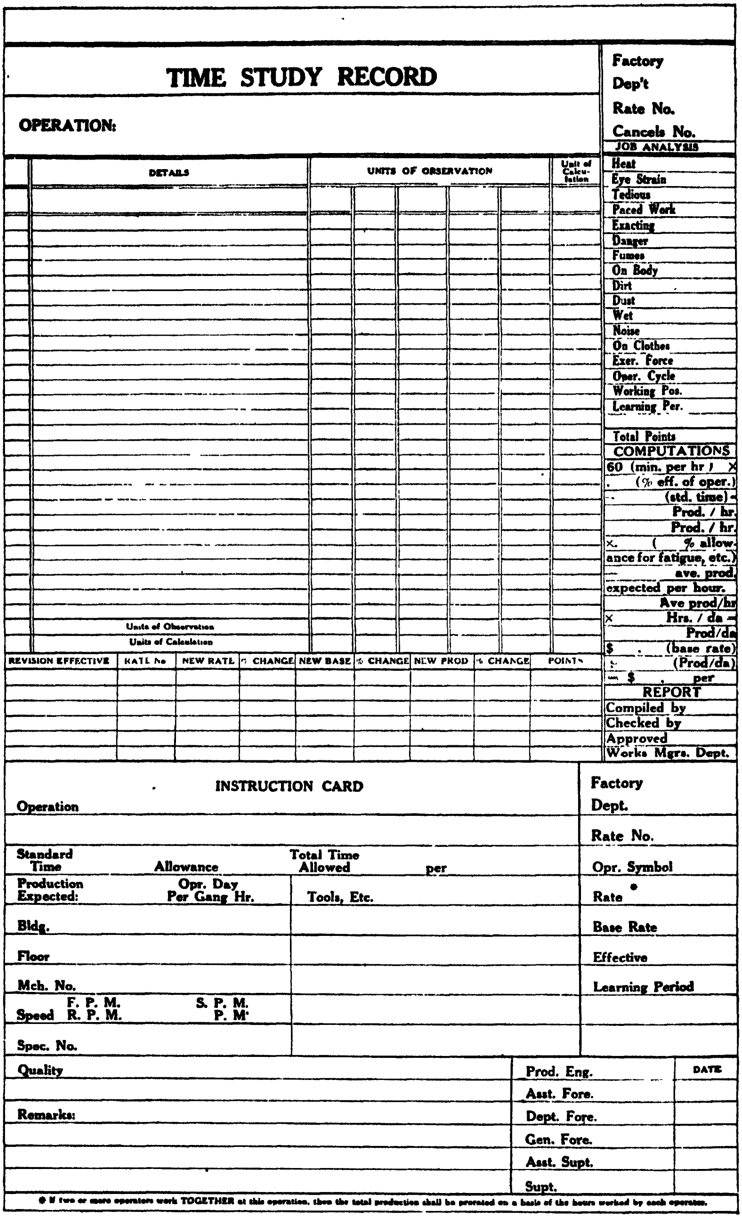
The Cost of Labor Turnover

In the administration of labor no subject is more important than labor turnover; it is in some measure the gauge of success and will often constitute the principal variable in the cost of labor itself. Wherever labor policy is a considerable factor, therefore, it is desirable to keep some record of the cost of labor turnover as well as of the extent of it.

To cover the latter point first, any well-organized labor department will keep records, by departments, of the total number of men employed by the company from time to time, the number taken on, and the number transferred from one department to another, resigned of their own accord, discharged for cause, and laid off for want of work.

Parallel to these statistical records a statement in dollars and cents of the cost of labor turnover will be serviceable. To this account should be charged the items named below. Not all of these items will appear in any given case, but when present they are chargeable to the cost of labor turnover.

1. Premiums or fees paid to employment agencies.



TIME STUDY RECORD

OPERATION:

Factory
Dep't
Rate No.
Cancels No.

JOB ANALYSIS
Heat
Eye Strain
Tedious
Paced Work
Exacting
Danger
Fumes
On Body
Dirt
Dust
Wet
Noise
On Clothes
Exer. Force
Oper. Cycle
Working Pos.
Learning Per.

Total Points

COMPUTATIONS
60 (min. per hr) ×
. (% eff. of oper.)
(std. time) ÷
Prod. / hr.
Prod. / hr.
×. (% allowance for fatigue, etc.)
ave. prod. expected per hour.
Ave prod/hr
× Hrs. / da =
Prod/da
$. (base rate)
÷ (Prod/da)
= $. per

REPORT
Compiled by
Checked by
Approved
Works Mgrs. Dept.

	DETAILS	UNITS OF OBSERVATION					Unit of Calculation
	Units of Observation						
	Units of Calculation						

REVISION EFFECTIVE	RATE No	NEW RATE	% CHANGE	NEW BASE	% CHANGE	NEW PROD	% CHANGE	POINTS

INSTRUCTION CARD

Operation

Factory
Dept.
Rate No.
Opr. Symbol
Rate ●
Base Rate
Effective
Learning Period

Standard Time
Allowance
Total Time Allowed per
Production Expected:
Opr. Day
Per Gang Hr.
Tools, Etc.
Bldg.
Floor
Mch. No.
Speed F. P. M. R. P. M.
S. P. M. P. M.
Spec. No.

Quality
Remarks:

	DATE
Prod. Eng.	
Asst. Fore.	
Dept. Fore.	
Gen. Fore.	
Asst. Supt.	
Supt.	

● If two or more operators work TOGETHER at this operation, then the total production shall be prorated on a basis of the hours worked by each operator.

Form 26: Time study record.

✓2. Advertising for help.

✓3. An apportionment of the cost of the employment office itself.

✓4. Cost of training, wherever a special department exists for that purpose.

✓5. Excess labor costs incurred by the new employee while his output is below normal.

✓6. Unabsorbed overhead of machines on which a new man is producing at a rate below normal.

✓7. Idle time on machines standing idle pending the hiring of operatives.

8. Cost of spoiled work, due to inexperience.

It is to be expected that the cost of labor turnover per man hired will vary between periods of active business and periods of depression. In the latter case the time required to find new employees will be shorter, and the larger numbers available will give a better selection. For these reasons many of the items listed above will tend to be smaller in dull periods than in busy seasons.

A number of cases are on record in which companies have kept account of the cost of labor turnover. In one instance it was computed that the cost of hiring a machine man of moderate skill in a factory turning out machinery as a product varied between $90 and $130 per man, the latter representing the cost in the busy seasons. The figures include, however, only three of the elements enumerated above, namely, unearned wages during subnormal production, unabsorbed machine burden due to the same cause, and burden on the idle machine while waiting for an operative. The last-named item alone caused the spread between the $90 and $130.

The uses of such a record would be to indicate a more profitable labor policy at various junctures. It might suggest, for example, a better planning of production to avoid peak loads and the consequent laying off and rehiring of men. The foreman is a principal factor in the situation, and foreman training might help to reduce the cost shown, in addition to affording other substantial advantages. The figures might, moreover, give a better index to the points at which it is desirable to transfer men between departments, to lay them off, or to retain them in spite of current subnormal activity.

Questions and Problems

1. What differences would you expect to find in the methods of payroll accumulation in a flour mill where costs were gathered on a process basis, as compared with a machine shop in which machines and parts were made to customers' orders, and costs were compiled on a job basis? Explain the reasons for these differences.

2. The Tamarack Press operates departmental work in process accounts, the debit balances of which, on February 1, 1929, were as follows:

Materials in Process	$3,784.60
Hand Composition Department	857.80
Machine Composition Department	1,339.50
Job Press Department	1,895.40
Cylinder Press Department	3,637.90
Bindery Department	1,165.80

When the payroll for February was analyzed, it was found to show the following results:

Office Salaries	$ 2,637.50
Superintendence	1,400.00
Hand Composition	4,784.30
Machine Composition	7,853.60
Job Press	5,937.80
Cylinder Press	14,294.50
Bindery	4,386.20

The amounts of burden or factory expense, including superintendence, chargeable to the departments were:

Hand Composition	$4,365.60
Machine Composition	5,717.20
Job Press	4,295.90
Cylinder Press	9,627.60
Bindery	3,139.50

Materials were put into process, the value being $27,560.40.

At the end of the month the cost of all jobs completed during the month were totaled and found to be:

Materials	$28,196.70
Hand Composition	4,215.50
Machine Composition	5,944.80
Job Press	4,303.20
Cylinder Press	9,755.40
Bindery	3,200.30

a. Show the work in process accounts, duly posted with the figures for the month, and with balances brought down.

b. What do the balances of these accounts signify?

3. What is the difference between productive and nonproductive labor? Has this difference any significance in cost accounting?

4. The Cherton Woolen Mills was engaged in the manufacture of cloth for both men's and women's wear and had been giving consideration to the question of wage rates in the spinning department, both as they concerned the actual reduction of costs and as they affected the calculation of the cost of finished cloth with a view to price making. The total payroll for

the year in the spinning department during 1930 was about $28,000, and the corresponding overhead allocated to the department was about $55,000. For these costs the total output during the year had been as follows:

Output of Yarn

Size, run	Yarn produced, pounds	Finished cloth produced, pounds	Weight per yard, ounces
¾	600,000	510,000	24
1¾	450,000	360,000	20
2½	400,000	320,000	14
Total	1,450,000	1,190,000	

Thus the output of the year had consisted wholly of three particular styles of cloth as indicated. The "run" means the size of the yarn; one-run yarn means yarn at 1,600 yd. to the pound; two-run yarn has 3,200 yd. to the pound; other run figures indicate proportionate quantities of yarn to the pound, the higher figures indicating the lighter weight yarns.

The mill superintendent of the Cherton Woolen Mills had secured a list of piece rates which were being used at another woolen mill some distance away, and which was as follows:

Yarn Size, Run	Rates per 100 Lb.
¾	$0.87
1	1.14
1¼	1.36
1½	1.64
1¾	1.88
2	2.16
2¼	2.41
2½	2.68
2¾	2.93
3	3.20

His impression was that these rates would represent lower labor costs in the spinning department than those of his own company, where men in that department were paid on daily rates. He therefore instructed the cost department to figure out a comparison of the probable results and also to suggest how the spinning piece rates would affect cost of production per yard.

a. Show the computation which the cost department should make.

b. Could the spinning rates above given be used directly to compute total costs per yard? Explain your answer.

c. How would you suggest that overhead be handled here?

d. Are there any other considerations to be borne in mind in connection with either the adoption of the piece rates or the computation of costs?

5. What would be the piece rate per dozen found in the Computations section on Form 26 under the following conditions:

· The efficiency of operation is figured at 80 per cent.

The standard time per dozen pieces is 10 min.; the shop is working 8 hr. per day, and the daily rate supposed to be fair for such work is $5.75. The allowance for fatigue and so forth has been fixed at 25 per cent.

6. How is the amount of wages accrued determined at the end of any period?

7. Where the payroll is accumulated by departments, how would you account for the temporary transfer of an employee from one department to another?

8. What method of wage payment might be used where the speed of the machine regulated the speed of the worker? Would your method be satisfactory in the spinning department of a textile mill where, although the speed of the machine might regulate the speed of the workers, the output would be reduced unless breakages were promptly repaired?

9. What checks might be provided to prevent the fraudulent addition of fictitious names to the payroll?

IX

INCENTIVE WAGE SYSTEMS

The Labor Problem

For the manufacturer, the problem of labor is the problem of obtaining a supply of help which is adequate to turn out the desired product, in desired volume, with such economy and efficiency that it can be sold at a profit in the market. There are thus included on the one hand the whole problem of "human relations," and all that is involved in having numbers of men cooperate for a common end, and, on the other hand, the correlating of expenditures made for productive purposes with the income to be derived therefrom. In the latter sense labor is simply one of the tools of production and a cost of production; as a tool it must be made to function as effectively as possible; as a cost it must be reduced to its lowest possible figures. But on the "human relations" side it is now generally recognized that these objectives of efficiency and low cost cannot be pursued in a purely mechanical and arbitrary fashion, as may be done with machinery and equipment; all the emotions, opinions, prejudices, and failings of human nature rise up to prevent it, and every intelligent manufacturer understands that his production plans must pay due regard to all these things. Nor should this condition be regarded simply as an obstacle to good results or as so much extra cost; to a constantly increasing extent managers have found that the most humane labor policy is likely in the long run to be also the most economical. Sickness, accidents, and discontent over wages or working conditions are hindrances to production; reasonable attempts to remove the causes of them are part of the work of getting the most out of labor, and the growing economic consciousness of labor places the workers in a position to insist on attention being paid to their wishes.

High Wages and Low Production Cost

Of all the factors entering into labor relations, the wage is the most important. What the worker wants is a weekly wage as high as possible, without undue fatigue or discomfort; what the employer wants is a unit cost of production as low as possible. The problem of labor is in large measure the task of reconciling these two conflicting considerations, and some of the outstanding business successes in the country bear evidence to the fact that they can be reconciled. It is therefore no longer thought necessary to secure low costs by forcing labor in a ruthless fashion; better results are obtained by enlisting the active support, loyalty, and cooperation of the workers by a reasonable concern for them. Still further, an able management is one which knows how to plan and organize work, to use the best possible equipment, and to provide the best working conditions; and these things, by facilitating production, provide the basis for an increased output without increased strain on the workers. Employers may be regarded as competing among themselves for the opportunity to employ labor, and those will get the labor who have the ability to use it most productively. Out of these conditions there emerges a long-run tendency for wages to rise, with a decreased cost of production per unit. Periods of depression may make temporary but serious interruptions in this process, but the general tendency will assert itself over long periods.

Incentive Wage Systems

In the search for a solution to this problem, a considerable variety of wage systems have been devised, departing in more or less degree from the simple basis of time or piece wages. These newer systems have aimed especially to hold some form of inducement or incentive before the eyes of the workers which would, it was hoped, enlist their best efforts and yet would safeguard the employer against loss from rising costs. On account of their novelty, and because of the claims made for them by their proponents, these incentive methods have attracted considerable attention, and it is necessary to examine briefly their possibilities, the extent of their use, and the special problems they present in connection with cost.

Extent of Use of Bonus Systems

First as to the extent of their use. No very complete records seem to be available on this point, but those which are available indicate that the incentive systems have not taken possession of the field to an extent as great as might be supposed from some of the writing on the subject. An investigation by the Department of Labor showed that in 1923 only 39 foundries out of 351 and 65 machine shops, out of 429 observed, were using any kind of special incentive method of payment; the rest were all using day-work or piece-work rates. An investigation made in Rochester, New York, showed that 7 out of 46 plants were using bonus systems; 4 of the 7 were using the Bedaux system. While these figures represent only samples and are by no means conclusive, they do suggest that the more old-fashioned methods are continuing to hold a large proportion of the ground. As is well-known, many of the large plants in the country have, in different departments, day work, piece-work and bonus systems all in operation.

Conditions of Their Success

Premium or bonus systems have operated successfully in a number of cases where a vigorous and effective management has overhauled the productive processes and has installed incentive plans partly as a means of enlisting the support of employees for the changes made. In some of these cases a change from day rates to piece rates was the objective, but the incentive plans were installed as a sort of halfway measure which was considered less likely to excite the antagonism of the workers. These, of course, are points in favor of the incentive systems; but it is not a correct view to assume that all the subsequent benefits and improvements in these cases were the direct result of the incentive wage systems, when in fact they were produced by the general revision of the manufacturing processes by a capable and energetic management. Many authorities who have studied this subject or have had wide experience with it hold the view that large economies are the product of good management rather than of any particular wage system. By this it is not intended to deny that incentive methods have scored many individual successes, and that sometimes it has been possible to install them when straight piece rates would have been opposed by the men. But it is unfortunate to let the impression grow that incentive wage methods can make up for the absence of good management.

One of the common criticisms leveled at piece wages by the protagonists of the bonus systems is that piece rates are apt to be set so carelessly that it has often been necessary to change them, with serious discontent among the employees as a result. With the bonus systems, it is claimed, minute care is essential in determining the various rates and bonuses. The latter part of this contention is true and Form 26 shows into what detail a study may go in order to be certain that the rates of remuneration are fair. It will be seen that the operations are reduced to their most simple elements, and times are set accordingly; the danger of serious error is greatly diminished. But it is only fair to say that the same attention could just as well be devoted to the determination of a piece rate, and just as satisfactory results would be likely to ensue.

Features of Different Systems

This is not the occasion for a detailed study of the many different methods of awarding a premium or bonus.[1] The common feature of them all is that they set a specified quantity of work as a standard task and then give the worker an additional reward for doing better than that task. Often the same name is used for a variety of practices, especially as regards the rate or percentage of premium to be used. In any actual case, therefore, it is not sufficient to mention only the name of the system; it is necessary to inquire precisely what method of computing the bonus is used. No attempt will be made even to mention all the different systems; a few typical cases will be explained, and under each attention will be given especially to two questions, namely, (1) how the hourly earnings of the worker vary when he increases his output, and (2) how the cost per unit varies when the output is increased. These, it has been seen, are the two principal phases of the labor question.

For purposes of illustration a few basic figures may be assumed, namely:

Standard rate per hour	60¢
Standard rate per piece	3¢
Standard output per hour	20 pieces
Standard time for task of 100 pieces	5 hr.
Standard wage for task of 100 pieces	$3

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[1] Those who desire a full and precise statement of the mathematical behavior of the various incentive wage plans and their effect on hourly rates and unit costs may be referred to Section 16 of *Management's Handbook,* Ronald Press Company, New York, 1924.

In these conditions, what is the effect, under each system, when a man does better or worse than standard?

Taylor Differential Piece Rate

As the name implies, Taylor's rate consists of two piece rates, one for substandard production, and a higher rate to go into effect when the worker reaches standard. This arrangement is a part of Taylor's philosophy of management; a rigid line is drawn between satisfactory and unsatisfactory performances. He endeavored in every way to assist the employee to reach the standard set, by teaching him, by providing the best tools and best working conditions, and by planning the work to the best advantage; if under these favorable conditions a man failed to reach the standard, Taylor wished to penalize him severely and even to remove him if his inability continued. The operation of the system may be seen by assuming a piece rate of 2.5 cents per piece for production taking more than standard time, and 3 cents for standard production or better. Then, using the foregoing figures:

Pieces	Time, hours	Total wage	Per piece	Per hour
100	6	$2.50	2.5¢	$0.416
100	5	3.00	3.0¢	0.600
100	4	3.00	3.0¢	0.750
100	3	3.00	3.0¢	1.000

Thus the cost per piece is constant for production taking more than standard time, and again constant, at a higher rate, for production at more than standard time. The man's hourly rate increases as his output per hour increases, with a substantial increase when he reaches standard. This latter was the weak feature; the penalty for just failing to reach standard was regarded as harsh and arbitrary; Taylor's successors accordingly tried to soften this feature and to produce a more gradual scale.

Gantt Task and Bonus Plan

Gantt, for example, guaranteed a minimum hourly rate for the task and paid a bonus for time saved as compared with standard. He worked out two forms of this method; under the latter form he paid the standard hourly rate until the worker reached the standard time for the task; then he paid a standard wage for the task, regardless of the time it took, plus a bonus, computed on that standard wage, for all time saved. Thus, with the foregoing figures, and assuming a ten per cent bonus for reaching standard:

Pieces	Hours	Total wage	Per piece	Per hour
100	7	$4.20	4.2¢	$0.60
100	6	3.60	3.6¢	0.60
100	5	3.30	3.3¢	0.66
100	4	3.30	3.3¢	0.825
100	3	3.30	3.3¢	1.10

While below the standard rate, therefore, every increase in output decreases the cost per piece, though the hourly rate remains constant. After reaching standard, every increase in output increases the rate per hour, though the cost per piece remains constant; it is in effect a piece rate at this stage.

Emerson Bonus Plan

Emerson endeavored to carry Gantt's idea of a graduated scale, and of encouraging the subnormal worker, still further. This he accomplished by the use of a graduated bonus in place of a fixed one, and beginning while the work was still substandard, instead of waiting for him to reach 100 per cent. In practice these bonus scales have varied; but, after setting the standard or 100 per cent accomplishment, bonuses might be paid as follows:

	Bonus, per Cent
For reaching 66⅔ % of standard	5
For reaching 80 % of standard	10
For reaching 100 % of standard	20
For reaching 125 % of standard	40
For reaching 166⅔ % of standard	60

the bonus being computed upon the wage for the time taken. The results are as follows;

Percentage efficiency	Hours for 100 pieces	Total wage	Per piece	Per hour
66⅔	7½	$4.725	4.725¢	63¢
80	6¼	4.125	4.125	66
100	5	3.60	3.6	72
125	4	3.36	3.36	84
166⅔	3	2.88	2.88	96

Halsey Bonus Plan

One of the most simple of the bonus plans was Halsey's: he proposed to give to the employee 50 per cent of all time saved, paying him at the standard rate per hour. The following figures result from this:

Pieces	Time, hours	Total wage	Per piece	Per hour
100	6	$3.60	3.6¢	60¢
100	5	3.00	3.0	60
100	4	2.70	2.7	67.5
100	3	2.40	2.4	80

Bedaux Point System

Under the Bedaux point system the work is expressed in points or *b*'s, a *b* being 1 min. work at standard; 60 points are therefore a standard hour's work. An appropriate hourly rate is given each man, this hourly rate being a guaranteed minimum. When he works faster than standard, his extra production is still expressed in *b*'s or points, and he is paid for them at 75 per cent of the standard rate, the other 25 per cent being distributed among the foremen, inspectors, and other such indirect workers; it is understood, under this system, that these indirect workers contribute actively to increased output, and they are supposed to be correspondingly rewarded. The operation of the Bedaux method is shown by the table below; in this table the figures in the column headed Pieces also represent the percentage of the actual production to the standard.

B's	Pieces	Time, hours	Total wage	Per piece	Per hour
450	150	5	$4.125	2.75¢	82.5 ¢
375	125	5	3 5625	2 85	71.25
300	100	5	3.00	3 00	60
240	80	5	3.00	3.75	60
180	60	5	3.00	5.00	60

In operation it is expected, and commonly realized, that the output will be well in excess of standard; in fact the average output of a factory which has reached a normal rate of production is 80 *b*'s per hour per man, or 133.33 per cent of standard. The advisers who install the system usually permit the plant officials to pick out the man who is deemed to be working at a standard rate, afterwards to be treated as 60 *b*'s per hour; if then the output ultimately arrived at, when the system is in full operation, is much less than 80 *b*'s per hour, it is considered that something is wrong. The case is unlikely, therefore, where substandard production would have to be reckoned with; and when production is better than standard the *b* is really constant, for 75 per cent of its standard value is paid to the operator, and the remaining 25 per cent to the indirect workers, making 100 per cent in all. In other words, it is, for cost purposes, equivalent to a piece rate.

Basis for Standards

It will be noted that all these methods require the setting of standards with which to measure the performance of the workers. The entire wage scale is arranged with reference to the standards. In general there are two bases upon which standards for this purpose may be determined. The first is the use of historical data, records of the actual performance of labor in the past. While these may make a good starting point, they have the defect of reproducing all the faults and shortcomings of past practices, the very things the business is trying to get away from. If, moreover, there has been considerable change in the layout and planning of work, as frequently occurs with the installation of an incentive wage plan, then the records of past performance do not fairly apply to present conditions. A second method is therefore usually favored by managers and engineers interested in developing a new wage system, and this method is time study.

"Time study is the name applied to determining, by careful analysis of everything that enters into an operation, how much time it should take to perform that operation."[1] This definition plainly states that "everything that enters into an operation" must be included in the time study. This includes not only the bare mechanical facts but also, as the writer quoted goes on to point out, the reactions of the worker to being time studied. Investigation work with a stopwatch can be a very irritating thing; it requires tactful, sympathetic, and experienced men; but where these are available, it has been found that satisfactory standards have been arrived at. The managers also need to be tactful, if they are to negotiate difficult situations with satisfaction to themselves and their employees. Wherever the management is considering any radical change of policy, it is always well to explain it carefully in a meeting of workmen, at which the latter are at liberty to ask questions, before the attempt is made at the actual introduction of the new methods.

Group Bonus Systems

It frequently happens that a group or gang of men work together in such a way that their product is the result of their united efforts, and it is almost impossible to tell which of them is at fault in the event of their output falling off. It is then desirable to give them all a joint interest in increasing the output, and this may be accomplished by paying each man an appropriate hourly wage and adding a bonus computed upon the joint output; the bonus is then divided among the group in some prearranged proportion, usually in proportion to their respective hourly rates. Thus in shipbuilding or boilermaking, riveters work in gangs, one man heating the rivets, another passing them, another drilling the holes, and another driving the rivets. An assembly on which several men work together is also a common case for the use of group bonuses. Still another case is a packing and shipping room in which goods must be handled by several men working together.

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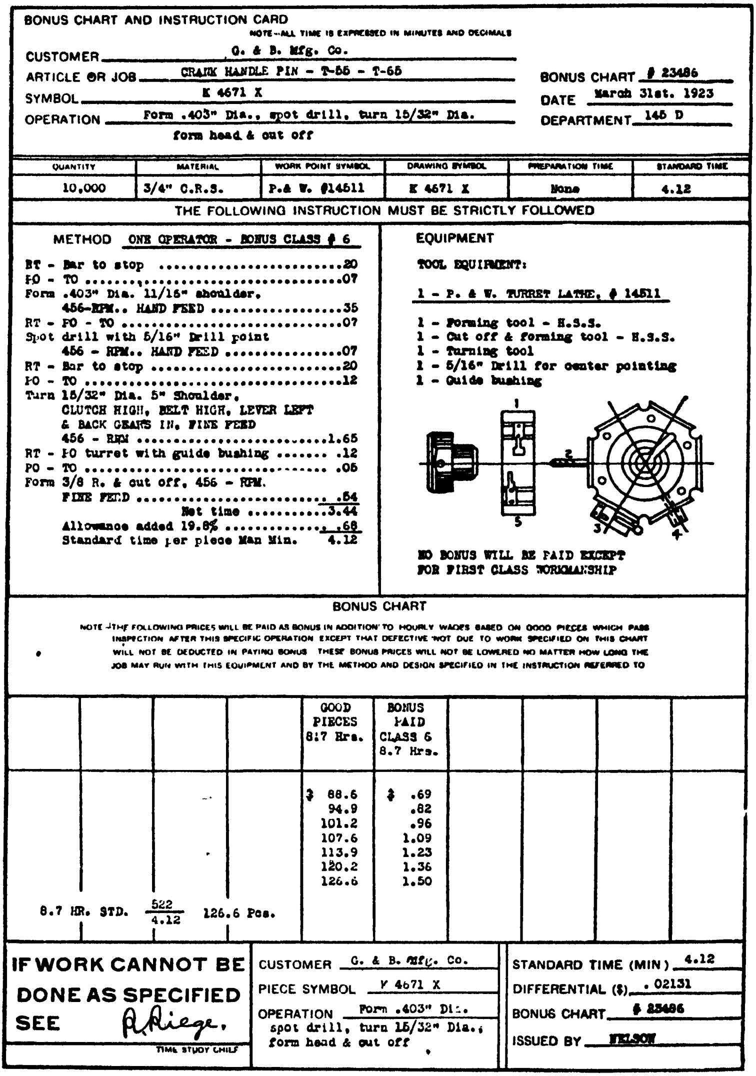
[1] *Bulletin of the Taylor Society*, April, 1932, p. 53.

The principle of the group bonus is sometimes applied in conditions where the men are not working on a joint product.



BONUS CHART AND INSTRUCTION CARD

NOTE—ALL TIME IS EXPRESSED IN MINUTES AND DECIMALS

CUSTOMER G. & B. Mfg. Co.
ARTICLE OR JOB CRANK HANDLE PIN - T-55 - T-65
SYMBOL K 4671 X
OPERATION Form .403" Dia., spot drill, turn 15/32" Dia. form head & cut off

BONUS CHART # 23486
DATE March 31st. 1923
DEPARTMENT 145 D

QUANTITY	MATERIAL	WORK POINT SYMBOL	DRAWING SYMBOL	PREPARATION TIME	STANDARD TIME
10,000	3/4" C.R.S.	P.& W. #14511	K 4671 X	None	4.12

THE FOLLOWING INSTRUCTION MUST BE STRICTLY FOLLOWED

METHOD ONE OPERATOR - BONUS CLASS # 6

RT - Bar to stop	.20
FO - TO	.07
Form .403" Dia. 11/16" shoulder. 456-RPM.. HAND FEED	.35
RT - FO - TO	.07
Spot drill with 5/16" Drill point 456 - RPM.. HAND FEED	.07
RT - Bar to stop	.20
FO - TO	.12
Turn 15/32" Dia. 5" Shoulder, CLUTCH HIGH, BELT HIGH, LEVER LEFT & BACK GEARS IN, FINE FEED 456 - RPM	1.65
RT - FO turret with guide bushing	.12
PO - TO	.05
Form 3/8 R. & cut off, 456 - RPM. FINE FEED	.54
Net time	3.44
Allowance added 19.8%	.68
Standard time per piece Man Min.	4.12

EQUIPMENT

TOOL EQUIPMENT:

1 - P. & W. TURRET LATHE, # 14511

1 - Forming tool - H.S.S.
1 - Cut off & forming tool - H.S.S.
1 - Turning tool
1 - 5/16" Drill for center pointing
1 - Guide bushing

NO BONUS WILL BE PAID EXCEPT FOR FIRST CLASS WORKMANSHIP

BONUS CHART

NOTE—THE FOLLOWING PRICES WILL BE PAID AS BONUS IN ADDITION TO HOURLY WAGES BASED ON GOOD PIECES WHICH PASS INSPECTION AFTER THIS SPECIFIC OPERATION EXCEPT THAT DEFECTIVE NOT DUE TO WORK SPECIFIED ON THIS CHART WILL NOT BE DEDUCTED IN PAYING BONUS. THESE BONUS PRICES WILL NOT BE LOWERED NO MATTER HOW LONG THE JOB MAY RUN WITH THIS EQUIPMENT AND BY THE METHOD AND DESIGN SPECIFIED IN THE INSTRUCTION REFERRED TO

				GOOD PIECES 8.7 Hrs.	BONUS PAID CLASS 6 8.7 Hrs.				
				$ 88.6 94.9 101.2 107.6 113.9 120.2 126.6	$ .69 .82 .96 1.09 1.23 1.36 1.50				
8.7 HR. STD.	$\frac{522}{4.12}$	126.6 Pcs.							

IF WORK CANNOT BE DONE AS SPECIFIED SEE R. Riege.
TIME STUDY CHIEF

CUSTOMER G. & B. Mfg. Co.
PIECE SYMBOL Y 4671 X
OPERATION Form .403" Dia., spot drill, turn 15/32" Dia., form head & cut off

STANDARD TIME (MIN) 4.12
DIFFERENTIAL ($) .02131
BONUS CHART # 23486
ISSUED BY NELSON

Form 27: Instruction card for use with bonus system.

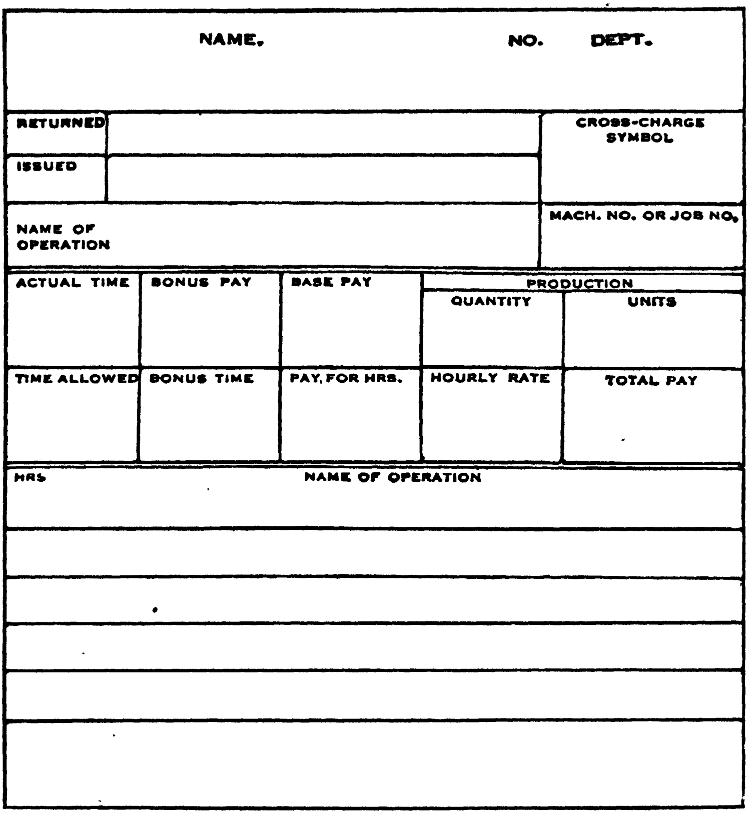
In a highly organized industry, such as the automobile industry, it is possible to group men working on the same operation, or even men working near together on different operations, to measure their total output and to pay them a bonus based upon it. The effect of this is to make the men watchful of each other and to eliminate from the groups men who tend to lower the output. Another benefit is the simplifying of the payroll compilation by reducing the number of units for which the bonus must be computed. In one case bonus records were necessary only for 78 groups instead of for 4,318 men; the payroll department was reduced from 80 clerks to 5. This is typical of the economies possible under large-scale production.

Labor Cost of the Product

In the varying conditions arising out of the employment of one of these premium or bonus systems, what shall be regarded as the cost of the product? Some men earn large bonuses, others making the same article earn a small bonus, and others are below standard and earn no bonus. As shown from the tables earlier in this chapter, a typical situation is that an increased output per hour decreases the unit cost to the employer. A few examples of the forms used to gather labor costs, and of the procedure followed with them, will assist in an understanding of how this problem is handled. It will be noted that the procedure used in conjunction with job costs may differ from that used with process costs; and as with all labor costs, the records must treat of several different points, namely, the actual operation itself, the compilation of the payroll, the costing of the job, or product, and the ledger accounts. All these points will be illustrated in the examples to be given.

Process Costs—A Soap Manufacturer

In the case of process costs being used, it is necessary only to charge all wages paid, standard and bonus, to the process or product worked on; by dividing the total production into the total cost, a unit cost is obtained which can be compared with a standard previously computed. Thus a soap manufacturer paid bonuses on several different bases, according to the nature of the work done. If the employees can vary their production, as they can, for example, in the packing departments, a bonus of 20 per cent of the standard time is paid to workers, as well as their standard wage. Thus if a crew working at standard rate can pack 340 cases in the working day of 8.7 hr., and the crew packed 350 cases in that period, they would be paid for $^{350}/_{340}$ times 8.7 hr., plus a 20 per cent bonus, making 10.75 hr. at the regular hourly wage. For those operators whose work affects the quality of the product, the bonus is computed according to the nearness they come to the standard specification, tables being prepared in advance for this purpose.



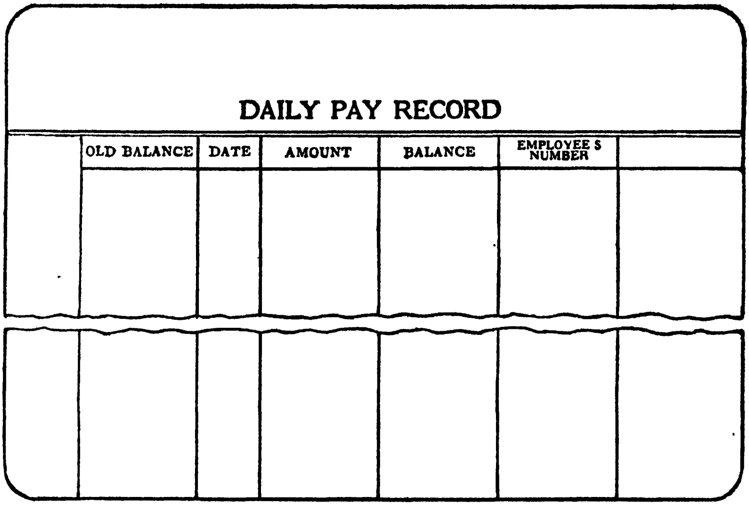
NAME.			NO.	DEPT.
RETURNED			CROSS-CHARGE SYMBOL	
ISSUED				
NAME OF OPERATION			MACH. NO. OR JOB NO.	
			PRODUCTION	
ACTUAL TIME	BONUS PAY	BASE PAY	QUANTITY	UNITS
TIME ALLOWED	BONUS TIME	PAY. FOR HRS.	HOURLY RATE	TOTAL PAY
HRS.	NAME OF OPERATION			

Form 28: Labor ticket for bonus system.

The payroll and other labor records are then made on Forms 28 to 32. Form 28 is the initial record, showing the man's name and number, the department in which he worked, the operation, and the time taken. If he worked on the same operation all day, he would have only one ticket for the day; if he worked on several operations, there would be one ticket for each operation. The tickets for each man are accumulated daily, and their total posted to the daily record, Form 29.

This is accumulated into weekly totals which are posted to both records in Form 24 (page 122) at one writing, thus preparing a yearly record for the man and the weekly payroll simultaneously.

The cost accounting consists simply in charging to each operation or product all labor costs incurred upon it. For this purpose a weekly payroll analysis is prepared (Form 30); all cards for the same operation are accumulated and posted to this record. When men are working on some other than their regular operations, special cards are written for them, and these are accumulated on a weekly summary of cross charges (Form 31) before being posted to the payroll analysis. On the latter record the total cost of each product is then shown for the week; by dividing the output into this total the actual unit cost is obtained and may be compared with the predetermined standard.



DAILY PAY RECORD

	OLD BALANCE	DATE	AMOUNT	BALANCE	EMPLOYEE'S NUMBER	

Form 29: Daily record per man.

Job Costs—Electrical Appliances

In the preceding chapter is given, with Form 25 to illustrate, the case of a company which manufactured small motors and signaling equipment and paid its employees a guaranteed hourly rate as a minimum but paid a piece-rate which enabled employees to profit by high production. This case is worked out fully in Chapter XVII, the Forrest Electrical Company,

WEEKLY PAY ROLL ANALYSIS

NO. SHEETS 2
SHEET NO. 1

1—Direct Labor
2—Indirect Labor
3—Supervision

Compiled by

Approved by

Date 193

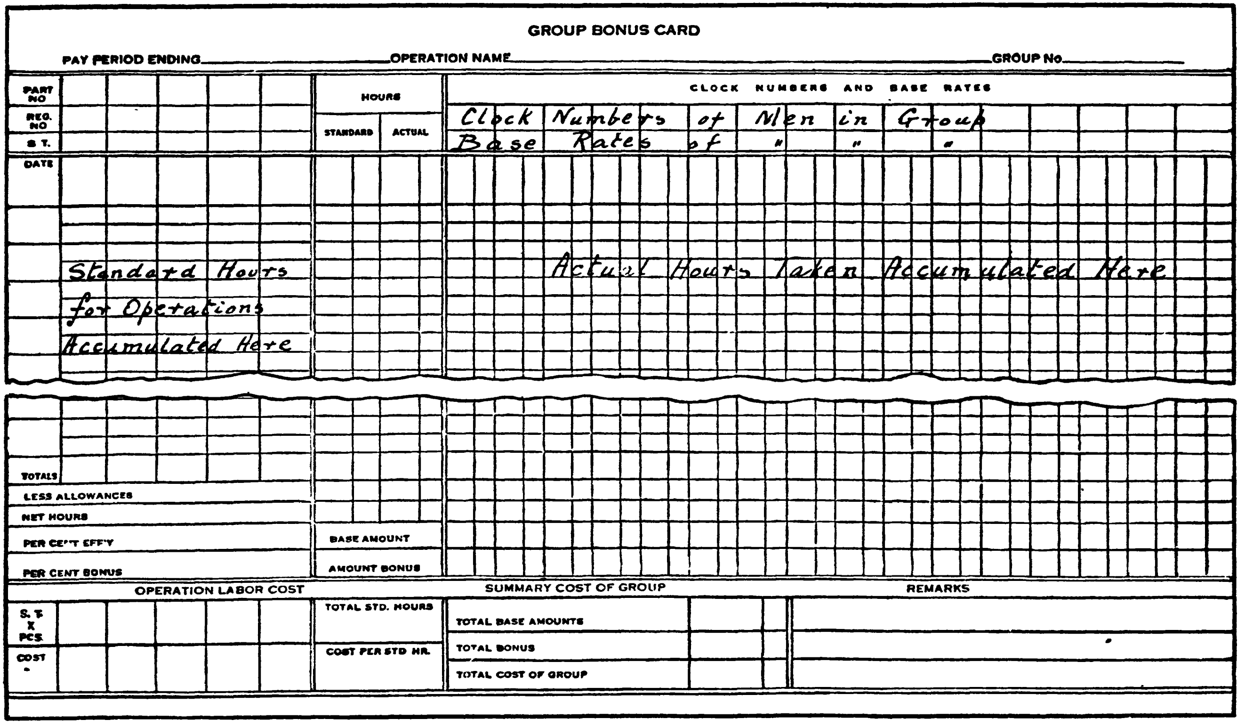
DEPARTMENT	Cross Charges		Actual Labor Cost	Actual Unit Cost	Cross Charges Hours		Total Actual Hours	Actual Employees	BRAND AND DEPARTMENT	Cross Charges		Actual Labor Cost	Actual Unit Cost	Cross Charges Hours		Total Actual Hours	Actual Employees
	Debit	Credit			Debit	Credit				Debit	Credit			Debit	Credit		
H—Handling Division (Material)									WF—No. 1 Crutching To Cutting								
									WF—1								
MH—1									WF—2								
MH—2									WF—3								
MH—3																	
									WCF Crutching Framing								
BH—Bleachery									WSF Stripping Cutting								
BH—1																	
BH—2																	
BH—3									MF—No. 2 Crutching To Stamping								
									MF—1								
CH—Caustic Storage									MF—2								
CH—1									MF—3								
CH—2																	
CH—3																	
									XF—No. 3 Mills Dryers								
RH—Refining									XF—1								
RH—1									XF—2								

Form 30: Weekly payroll analysis.

WEEKLY SUMMARY OF CROSS CHARGES 192

CREDIT			DEBIT												
DEPT.	AMOUNT	HOURS	M H—1	B H—1	B H—S	C H—1	S C H	S Y H	S F H	S M	L F—2	L C F	L S F	W F—2	W C F
M H			Hrs. Amt.					(List Matl)							
B H															
R H															
S H															
S M															
L F															
W F															
X F															
T F															
P F			W S F	M F—1	X F	R F	T F—1	P F—1	G F—1	G F—2	Z C F	Z S F	Z F—2	Z F—3	SP—1
Z F															
L P															
W P															
M P															
X P			SPECIAL	Spun Soap	No. 3 Jav	Araby	R H W Inv								
R R															
T P															
P P															
M A															
S A			S P—1	L P—1	L P—2	W P—1	W P—2	U P	M P—1	X P—1	X P—2	R P—2	R P—1—100	R P—1—34	T P—2
W A															
TOTAL			P P—1	P P—2	Z P—1	Z P—2	Z P—3	A A—2	L A—2	M W A	M T A	M O A	R A—1	R A—2	S A—1.
			S A—2	S T A	T A	U A	W A—1	W A—2							

Form 31: Weekly summary of cross charges.



GROUP BONUS CARD

PAY PERIOD ENDING ______ OPERATION NAME ______ GROUP No. ______

PART NO

REG. NO

S T.

DATE

HOURS

STANDARD

ACTUAL

CLOCK NUMBERS AND BASE RATES

Clock Numbers of Men in Group

Base Rates of " " "

Standard Hours for Operations Accumulated Here

Actual Hours Taken Accumulated Here

TOTALS

LESS ALLOWANCES

NET HOURS

PER CE'T EFF'Y

PER CENT BONUS

BASE AMOUNT

AMOUNT BONUS

OPERATION LABOR COST

S. T. X PCS.

COST

TOTAL STD. HOURS

COST PER STD HR.

SUMMARY COST OF GROUP

TOTAL BASE AMOUNTS

TOTAL BONUS

TOTAL COST OF GROUP

REMARKS

Form 32: Group bonus card.

with exercises to show how the hourly wages and bonuses are accumulated, and ultimately posted as charges to the order, on the back of Form 55 or Form 58, on pages 313 and 315. That case is an example of the many ways in which a bonus system may be adapted to meet special circumstances, and the records designed accordingly.

A Group Bonus Record

Form 32 is an example of another type of record used with a bonus system, in this case a group bonus. Since the bonus earned by the group is paid to men in the group in proportion to their hourly rates, there must be some method of computing the amount due to each man; Form 32 serves that purpose. At the left the standard times allowed on operations performed by the group are shown; at the right appear the actual times put in on those operations by men in the group, thus enabling a comparison to be made between Standard and Actual in the columns entitled Hours. At the bottom the totals are shown and analyzed, with the amounts owing to each man at his hourly rate, with bonus added.

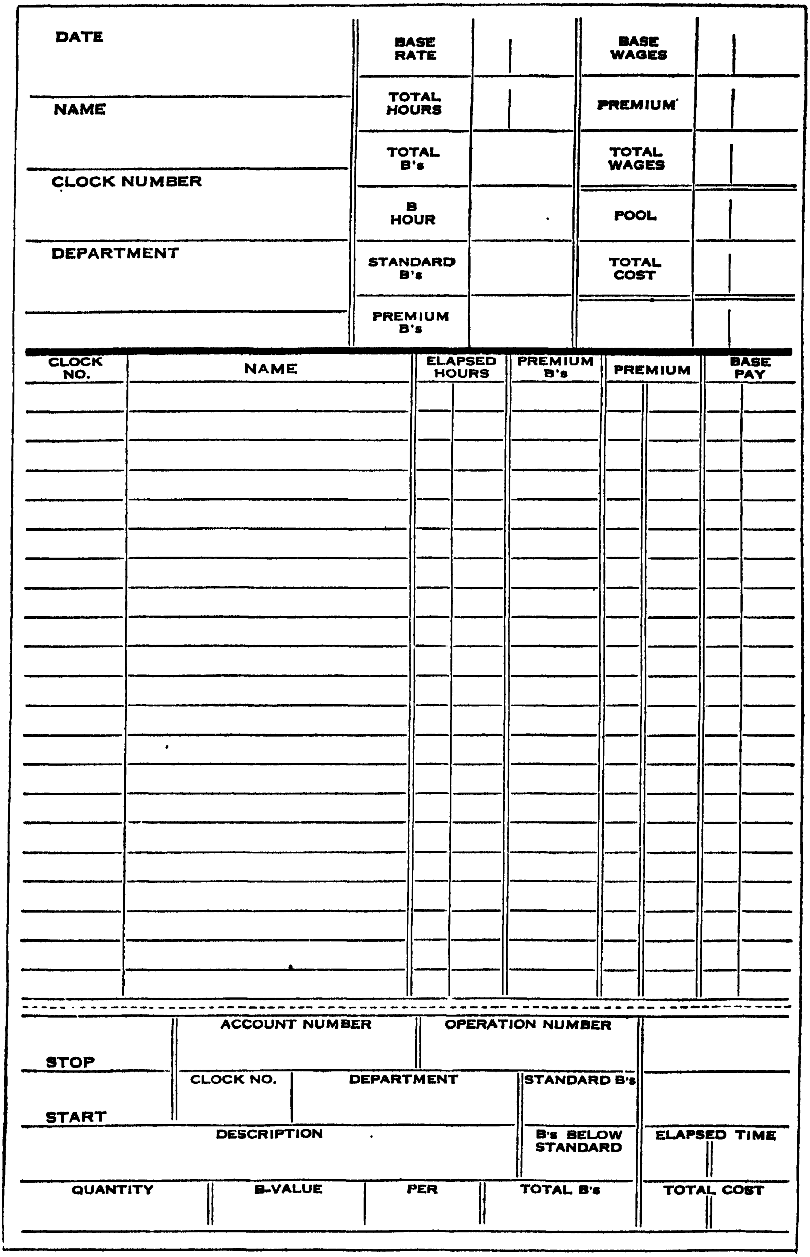
Crew Coupon Ticket for Bedaux System

Form 33 shows a ticket in coupon form, to be used for a group of workers, under the Bedaux premium system. Only one coupon is shown in the illustration. In the original, six such coupons were attached to the main form, to record operations on six different lots of work. In addition to providing space for the hours of work and for base or standard pay, there are also spaces for the premium *b*'s or bonus points earned by the crew and the amount of premium which these represent in money. The names of the operatives in the group are listed in the middle of the form.

The total time and earnings of the group are noted at the top of the form, and these earnings will be distributed to different jobs or operations according to the coupons attached at the bottom.

Essentials of the Bonus Systems

The friends of the bonus systems claim that they reduce the labor cost per piece, and the claim has been justified in many cases. This means that the worker receives a lower



DATE	BASE RATE	BASE WAGES
NAME	TOTAL HOURS	PREMIUM
CLOCK NUMBER	TOTAL B's	TOTAL WAGES
DEPARTMENT	B HOUR	POOL
	STANDARD B's	TOTAL COST
	PREMIUM B's	

CLOCK NO.	NAME	ELAPSED HOURS	PREMIUM B's	PREMIUM	BASE PAY

STOP	ACCOUNT NUMBER		OPERATION NUMBER	
START	CLOCK NO.	DEPARTMENT	STANDARD B's	
DESCRIPTION			B's BELOW STANDARD	ELAPSED TIME
QUANTITY	B-VALUE	PER	TOTAL B's	TOTAL COST

Form 33: Crew coupon ticket for Bedaux system.

rate per piece, and it is a fair question to ask: How do the bonus systems succeed? It is important to be clear on this point. First, it is necessary to assume that, prior to the installation of the bonus system, the best possible results were not being obtained; this may have been the fault of the workers or of the management, but in either case it is possible to increase their output, and the success of the new wage plan depends upon accomplishing this. With this object the new plan proceeds (1) to facilitate the increase in output, by good organization and helping the worker in every way, (2) to measure the performance of the worker, so that changes in output are plain to all, (3) to offer an incentive for increased production. This combination seems to have good psychological results; the efforts of the management to assist the worker to do better cannot fail to impress him favorably; the open measurement of his output makes him ashamed not to improve, and the incentive to do better completes the appeal and he is won over for the wage plan. But the absence of any of these contributing factors will mar success. It may be granted that improved methods, improved devices, improved planning and routing might be made to accomplish the same thing; but experience in many cases seems to show that a carefully devised premium or bonus system may be a valuable ally in enlisting the cooperation of the employees in making the improved methods a success. The problem is not a single or a simple one; neither improved methods nor a bonus system is likely to succeed alone.

Executive or Key Man Bonuses

Although this chapter deals primarily with incentive wage systems for direct workers, it is appropriate at this point to make reference to giving bonus rewards to executives, a movement which has in recent years assumed considerable proportions. This is, of course, only an extension of the idea that every man, from the most humble manual worker to the highest type of executive, will respond to a system of rewards which makes it worth while for him to put out his best efforts. It is true that different men in different conditions will require different types of incentives to energize them, but that requires only that the form of bonus best suited to their conditions be worked out.

Executive bonuses may be divided into two main groups: first, those of a strictly departmental nature and therefore applicable to department heads; second, those based upon the general results of the business and therefore applicable to general executives.

Departmental Executive Bonuses

Departmental bonuses may be paid to foremen, superintendents, and department or office managers, in proportion to their performance in certain important aspects of their work. In many cases the reduction of expenses is made the basis for the bonus; that is, a standard or budget is set for the expenses of the department and the department head is given a progressive bonus in proportion as he is able to make savings from the standards set. In other cases the volume of output is regarded as the important thing, and bonuses are given in proportion to the increases in output over the standard. Very often this type of bonus is connected with the first type by specifying that the increased output must be obtained within certain cost allowances. In still other plants, quality of performance is the important element which it is considered should be rewarded by the bonus, which is then paid in proportion to the reductions made in the number of seconds or spoiled pieces turned out. In a glass factory or other place where breakages are common the bonus may be given for reducing losses from this cause; in a cotton-finishing plant, and still more in silk finishing, the bonus may be given for the smaller proportions of seconds and of finishing faults for which the business has to make allowances to its customers.

Thus the problem is to pick out those factors which are regarded as the most important and desirable things for the foreman or other department head to accomplish, and to reward him in proportion to what he does in those matters. It may well be that the basis may change within the same department; at one time quality may be the important thing; then after that has been brought to satisfactory levels, the reduction of expense may become the important factor; any combination of these types of bonuses may be worked out to effect the purposes of the general management. It is, of course, necessary to avoid allowing this to become too complicated in operation; though, since the number of executives is small compared with the number of direct workers, it is permissible for the bonus plan for the former group to be more complex than that for the latter group.

Bonuses for General Executives

There is a fundamental distinction between the nature of the bonuses discussed here and those mentioned in the preceding paragraph. General executives are responsible for the profits of the business, and therefore it is possible to relate their bonuses to the profits earned. Department heads are ordinarily not supposed to be able to influence profits directly, and their bonuses are paid upon the basis of performance within their departments, regardless of the ultimate profits of the company.

The question whether any particular executive should be treated in this respect as a department head or general executive cannot always be determined merely from his title. The real question is whether he has any substantial part or influence in formulating the general policies of the business, upon which its net profits really depend; if he does not, it is a wrong principle to pay him a share in profits, thus making part of his remuneration contingent on the earnings of profits. Such a man, if he is to receive a bonus, should be paid for results for which he is directly responsible, which means the results of his own department.

Calculation of Bonus Share in Profits

A few general principles have come to be accepted in connection with the calculations for determining the total amount available for bonuses of the profit-sharing type and the amount which should be paid to each individual executive. With regard to the former question it is generally agreed that provision should first be made for stockholders, the owners of the business, by allowing them a fair return on their invested capital, before any amount is paid to executives over and above their regular salaries. A fair return in this connection has been interpreted as anywhere from 5 to 8 per cent on the invested capital, that is, on the combined capital stock and surplus; 6 or 7 per cent have been the figures more commonly used. When this percentage has been deducted from the total net profits, the balance may be regarded as surplus earnings arising from the special advantage of the industry, the exceptional skill of the executives, or other favorable circumstances. A consideration of just what these favorable circumstances are will suggest some basis for division of this surplus as between the stockholders and the executives. In different companies an allocation has been made for bonus funds ranging anywhere from 5 to 25 per cent of the surplus net profits, that is, the amount of net profits over and above the agreed fair return on investment.

The second question, how much should go to each executive, has in general been worked out by means of a point rating plan, in which ratings are given to the executives for the various qualities which are regarded as contributory to the earning of profits. One tabulation of such ratings is given in Form 34; it will be seen that ratings are there given for (1) performance, that is, actual measurable accomplishments; (2) the extent to which the executive is in a position to influence profit earning; (3) recognition for his membership on various executive committees; (4) his personal characteristics and willingness to cooperate; (5) special performances beyond his regular work; (6) extra ratings awarded by the president for anything not elsewhere included. The point ratings arrived at in the last column were worked out on a percentage basis, and that percentage was applied to the man's salary to compute his bonus. In other cases the total number of points awarded all executives has been divided into the total amount of bonus money available, thus obtaining the value for each point. Then each man's bonus is computed by multiplying the number of points awarded to him by the value per point.

Incentives in Depression

Question is sometimes raised as to what may be the effect of periods of depression upon the operation of incentive plans. In the case of direct workers a period of depression brings two contrary influences to bear; on the one hand, employees fear to lose their jobs and will try to make their best showing, while, on the other hand, they are likely to stretch out what work there is over as long a time as possible. Experience shows that a well-planned incentive wage system helps in maintaining performance during such periods. Under the Bedaux system, for example, departmental efficiency may be measured quite closely; one company using this system showed a point average slightly above 80 during 1927 and 1928; for the whole of 1929 the point average was a fraction higher than

SCHEDULE OF UNITS ASSIGNED UNDER SALARY—MERIT-POINT SYSTEM

Name	Position	Years of service	Salary	Units assigned beginning of year	Merit-point ratings earned during year						Total ratings	Adjusted salary basis	Units assigned
					Performance (maximum 20%)	Scope of profit potentiality (maximum 20%)	Membership executive committee (maximum 20%)	Cooperation personal characteristics (maximum 20%)	Special performance outside regular duties (maximum 20%)	Super ratings (no maximum)			
J. Jones........	Manufacturing division	12	$ 20,000	400	15	20	0	15	0		50	$ 30,000	400
B. Smith......	Sales division	5	20,000	400	10	20	0	10	0		40	28,000	372
R. Roe........	Counsel	7	20,000	400	20	0	20	5	10	25*	80	36,000	480
J. Doe........	Treasurer	10	20,000	400	20	5	20	15	0		60	32,000	427
Total.......			$200,000	4,000								$515,000	7,000

Total units available	10,000
Assigned at beginning of year	4,000
Assigned at end of year	7,000
Reverting to company	3,000

* Credit for successful settlement license—pooling agreement.

Form 34: Rating executives for bonus.

either of these years, and for 1930 it was the same as in 1928. No doubt other companies have had similar experience, and it may be said that not only are standards fully maintained under the incentive plan during periods of depression but opportunity is found to tighten up the standards themselves.

Practically the same conclusion may be reached with regard to executive bonuses based upon departmental performance; but with profit-sharing bonuses the evidence is much less certain. When companies are not earning profits, this part of executives' incomes disappears entirely, and the executives do not in all cases bear this with equanimity. Perhaps the profit-sharing plan was instituted in prosperous times and they had gained the impression that they would always receive large bonuses. But the circumstances here mentioned really raise question as to the fundamental theory of profit-sharing bonuses. They represent an attempt to apply to executives some of the elements of a single proprietorship business; they transmit to corporation officials some of the risks of the man in business on his own account. The real question is, therefore, whether they are the kind of men who will welcome this speculative element and will react favorably to it. If they are working for a corporation because they want to have the protection of a regular job with a regular salary and are unwilling to expose themselves to the ups and downs of business on their own account, it may be inferred that profit sharing will be distasteful and will not bring out their best service. If, on the other hand, they are more adventurous spirits who are perfectly willing to take some of the risks of business and will be exhilarated by them, then satisfactory results will be likely to follow from the adoption of profit-sharing bonuses. In practice, of course, men are not wholly of one kind or the other; but according as the cautious or the adventurous element predominates in them, so will the results be in this matter. At any rate care should be taken to avoid raising in them exaggerated hopes of what they are likely to receive under the plan.

One circumstance that may bring the introduction of some profit-sharing plans in the period just ahead of us is the fact that many drastic cuts in salaries have been made, and the companies will be reluctant to bring them back to anything like their former levels. On the other hand, when better times come, they will be in danger of losing some of their best executives unless they do offer substantially increased compensation. A profit-sharing plan may be one of the best means of meeting this situation.

Questions and Problems

1. What do you mean by a premium or bonus system, and what is it intended to accomplish?

2. What is the effect of most of the premium systems in regard to (*a*) the employee's hourly rate of earnings, (*b*) the labor cost per piece to the proprietor, when output increases?

3. If you were a machinist in a factory, which would you prefer to receive (*a*) a straight piece rate on your output or (*b*) a premium or bonus for increased output, similar to those described in this chapter? Give your reasons.

4. If you were an employer of labor, would you prefer to pay your employees on straight piece rates or on an incentive wage system? Give reasons, and make such qualifications as you consider necessary.

5. The Tandex Lathe Company accumulates costs by the job and operates on a wage system under which a guaranteed minimum is paid to the men and a bonus for exceeding standard production. Total figures for the month show:

Direct wages paid, excluding bonuses	$3,784.60
Bonuses paid for outputs over standard	657.80
Total amount of direct payroll	$4,442.40

Included in the wages paid was the sum of $365.30, paid as a result of guaranteeing a minimum; in other words, the direct wages at standard rates would have been $3,419.30.

Show by journal entries how you would record the foregoing information in ledger accounts; explain the entries fully. On what basis would you make charges to the individual job cost sheets?

6. If the figures given in the preceding question occurred in a plant operating on process costs, how would the amounts be entered in the ledger accounts?

7. Under what conditions might a point system be substituted for piece work?

8. Do you consider that a company's own engineers should install an incentive system, or would it be preferable to employ outside consultants?

9. Would you expect labor to be more or less efficient in periods of depression than in normal times?

10. When should an incentive plan of wage payment, based upon individual effort, be replaced by a group bonus method of reward?

11. What factors should be considered in establishing an incentive plan for foremen?

12. What type of incentive wage system would you use where high quality of product is of the utmost importance?

X

BURDEN—ITS CONTENT AND ACCUMULATION

Manufacturing and Commercial Overhead

Overhead, or burden, includes all costs which are not capable of being directly charged to the product; in other words, it includes everything except direct labor and direct materials. Probably the most difficult problem in costs is to prorate these expenses to the product on a basis which is at the same time fair and simple in operation.

The first main division of overhead is into the manufacturing and the commercial costs. There are some items of expense, such as the salaries of the general officers of the corporation, which are common to the whole business, and are sometimes treated as a third group known as administrative expenses. These, however, can be apportioned as between manufacturing and selling operations, perhaps in proportion to the amount of time or attention which the executive officers give to these two functions.

It is chiefly with manufacturing burden that cost accounting has hitherto dealt; more and more attention, however, is being given to the matter of analyzing selling costs with a view to judging the results obtained. The line of approach and the method of distributing charges follow the same general lines as in manufacturing accounts. Some consideration is given to this subject in Chapter XIV.

Separation of Manufacturing and Selling Costs

One of the first questions which must be answered in devising a cost system is whether its object is to get a cost to *make* the goods or a cost to *make and sell.* It is, of course, possible to do both, to get the manufacturing cost proper and then to find an additional cost per unit of selling the goods; some such computation, in fact, must be made in order to fix an intelligent selling price. There are, however, several reasons for not combining the manufacturing and selling expenses.

The first is that generally speaking, the inventories of work in process must for balance sheet purposes be valued at their manufacturing cost; the inclusion of selling expenses in the inventories is regarded as unwarranted inflation. There is one exception to this rule, or rather one class of exceptions; when goods are being made to customers' orders, that is to say, when they have been sold before they are made, it is considered permissible to include a proper proportion of selling expenses in the value of the inventory.

Another general consideration is that cost accounting should follow the lines of the responsibility of the executive officers; the figures should be so compiled that they may be placed before individual officers as the direct results of their administration. If, therefore, selling and manufacturing expenses are intermingled, it would be impossible to use the resulting figures to judge the accomplishment of either of those departments separately. Therefore even when it is intended to accumulate a total cost to make and sell, the two main divisions of that total should be kept distinct. The same remarks apply to the administrative expenses of the general office.

Fixed and Variable Expenses

An important division to observe is that between fixed expenses and variable charges. Any manager of experience will know that these terms can be used only in a general sense; no items of overhead are absolutely fixed, and few vary directly with the product. Some items do, however, tend to move fairly closely with the output; they include such costs as power, liability insurance on employees, and supplies. Other items such as rent, depreciation of equipment, property taxes, and fire insurance tend to remain fixed in total amount unless substantial changes take place in the organization or in the plant itself.

The reasons for making this distinction between fixed and variable charges are, first, in order that due attention may be given to the variable charges which, being subject to control, ought to be more carefully watched; second, and even more important, to enable computations to be made of the relationship between volume of output and the cost per unit. As far as the fixed charges are concerned, every increase in output decreases the cost per unit in direct proportion; no such decrease results with the variable charges. Therefore, in determining such questions as the lowest volume which can yield a profit and the amount of extra profit to be made by increasing output, the relative amounts of fixed and variable expenses are important.

In some plants careful studies are made of the way in which expenses act when output changes, with a view to finding how much the expenses change. The result of such studies is to enable the management to know how much the expenses should amount to at any given rate of output.

Fixed and Variable Costs Further Defined

It will be well to define still more precisely what is meant by "fixed" and "variable" costs. The terms relate to the *total* amounts of the cost items; it is they which either are fixed, regardless of the quantity of goods produced, or vary with the quantity of goods produced. The exact converse is true when we come to speak of the costs *per unit*. Depreciation is commonly a fixed charge; a total amount of, say, $40,000 a year is charged against operations by a tire manufacturer, regardless of the number of tires produced. If in one year 100,000 tires are made, this means 40 cents per tire for depreciation; in the next year 160,000 tires are made, or only 25 cents per tire; next year the output may be 80,000 tires, when the charge becomes 50 cents per tire for depreciation. In other words, so-called fixed charges are variable charges in figuring actual per unit costs. In a later chapter, dealing with standard costs, it will be seen that some modifications of this idea occur.

With variable costs it is the other way round; the total amounts of these costs vary directly with the volume of output, and they are fixed costs per unit. This is most easily seen in labor costs, especially when piece rates are used. If the rate paid is 10 cents per piece, that becomes a fixed charge against each piece, and the total amount paid will vary directly with the number of pieces. The same thing is true of the material costs and, in a less degree, of the variable parts of burden.

An Example of the Effects of Fixed and Variable Costs

The important results which flow from these considerations may be seen from an example of a common type. Because of the nature and amount of these fixed charges and the fact that they decrease per unit as volume increases, it is a prevalent idea among business men that a large volume should be their main objective, and that they can afford to cut prices in order to secure the greater volume. But they are often very hazy as to the possibilities in this direction; apart from the marketing difficulties, a few calculations will throw some light on the limitations of action in this direction.

Suppose an operating statement reads in brief as follows:

Sales: 140,000 units	@ $12.00		$1,680,000
Materials: 140,000 units	@ 3.00	$ 420,000	
Labor: 140,000	@ 4.00	560,000	
Variable Burden: 140,000 units	@ 2.50	350,000	
Total Variable: 140,000 units	@ 9.50	$1,330,000	
Fixed Charges		210,000	
Total Costs			1,540,000
Net Profits			$ 140,000

The question now is, if it is proposed to cut prices, how much extra volume must be secured to make the same amount of profit as at present, supposing the price reductions to be 5 or 10 per cent? The calculations would be:

After 5 per cent reduction new price would be:

$12.00 less 60¢	$11.40
Total variable costs	9.50
Contribution to Fixed Charges + Profit	$ 1.90

Fixed Charges + Profit = $210,000 + 140,000 = $350,000.

$$\text{Output required} = \frac{\$350{,}000}{1.90} = 184{,}210 \text{ units.}$$

Proof:

184,210 units sold @ $11.40		$2,099,994
Less Costs:		
Variable: 184,210 @ $9.50	$1,749,995	
Fixed	210,000	1,959,995
Net Profit		$ 140,000

Thus ignoring small fractions the same result, a profit of $140,000, is arrived at as before. A similar calculation would show that, after a 10 per cent cut in costs, 269,231 units would have to be sold to make the same profit as before.

When these results are clearly seen, it is likely that the management will hesitate to take such steps, at any rate unless and until some substantial cost reductions can be effected. In that case, if the price reductions can be made coincidentally with the cost reductions, the same volume as before will obviously give the same profit. The disastrous effects of ill-advised price cutting will thus be avoided.

Gathering the Data for Burden

Care must be taken to see that all manufacturing expenses not included as direct materials or direct labor are brought into the computation of burden rates. For this purpose it is desirable to begin with the operating statements for several years preceding; all known or anticipated changes can be used in the preparation of an estimated statement of burden for the coming period. Prior to the actual distribution process by which burden is charged to the product, it is desirable to consider the handling of certain items, and it is helpful if some items are grouped together; consideration will be given to this in the following paragraphs.

Rent

If the premises are not owned, the rental paid to the landlord is the cost of the space occupied; sometimes extra charges for light, heat, and water are included in the monthly payment to him.

If the premises are owned, it is customary to build up a rental charge out of the annual expenses of providing and maintaining the land and buildings. This will usually include property taxes, insurance, depreciation, repairs and maintenance of buildings, and sometimes interest on the capital invested in the premises. In the case of a single building containing all departments of the plant, it is convenient also to include the building repairs in the rental charge; in a large plant where different departments occupy different buildings it may be more desirable to keep the repair expenses separate and allocate them directly to the departments on which they are incurred.

The total rental charge thus built up of the expenses incurred on property owned will, in the distribution, be treated in exactly the same way as a single amount paid as rent to a landlord.

Interest on Investment

There has always been much controversy on the question whether a charge should be included among the manufacturing expenses for interest on the capital invested in the business by the proprietor. Many contend that whether the proprietor owns or borrows his own capital he is directly or indirectly at the expense of the interest upon it; it is further argued that a comparison of manufacturing costs between different processes in the same plant, or between different plants, is not valid unless due regard is paid to the differing amounts of capital invested, by allowing a reasonable rate of interest upon these investments.

For the most part the question of the inclusion of this charge has in practice been answered in the negative; generally the great manufacturing concerns of the country, with the most able accounting advice at their disposal, have not included a charge for interest on invested capital; and, of some 550 firms which answered the questionnaire sent out by the National Association of Cost Accountants, about 80 per cent objected to the inclusion of interest. On the other hand, of the several hundred trade associations which have prepared uniform cost systems which they advise their members to adopt, the great majority have included interest on investment among the costs of production.

The arguments against its inclusion are that it is not really a cost but only an opportunity foregone; and the capital in buildings and equipment for a certain industry having been once invested, that capital is no longer free for investment elsewhere. Furthermore, it can only be recorded as a cost by making at the same time a contra entry recording a profit. The process, therefore, in effect anticipates a profit rather than recording a cost. Most objectionable of all, the cost recorded is afterwards transferred into the inventories and results in an inflation of their values; this is the principal ground on which the public accounting profession has opposed the practice.

The chief reason why the trade associations have included an interest charge is that they wish to be sure that their members know what price they should get if they are to cover all their costs of production and make a reasonable profit; it certainly is true that the profits of the business should include a reasonable rate of interest on its invested capital plus a return for the risks it undertakes and for the ability of its management. In setting selling prices all these things ought to be taken into account by an individual concern.

Trade associations also sometimes desire to collect the cost figures of their members and collate them into composite totals or percentages. When this is done, it is desirable to have all the firms on the same footing, and one measure essential for this purpose is to include interest on all capital invested in the business, whether owned by the proprietors or borrowed.

In summary it may be said that the accounts of an individual concern will be better without the inclusion of interest on invested capital; but the legitimate purposes of a trade association may in some respects be helped by including it in the accounts of their members. When it is done, a reserve should be set up to deduct any interest which may be included in the inventories on hand. This question is further discussed in Chapter XXV as a factor in costs under the N.R.A. codes.

Depreciation

A regular charge for depreciation should be included in the burden items; if the cost records are tied in with the financial records, this will mean that the same amount will be added annually to the depreciation reserve in the balance sheet. There is some difference of opinion among business men as to whether it is thus necessary to provide a regular allowance for depreciation; many contend that this matter may be left to the discretion of the financial management, who, it is said, may provide reserves for depreciation as and when they see fit, on condition that they provide a sufficient reserve to maintain the plant over a series of years. This question will not be argued here; whether the reserves in the financial accounts are set up by regular annual instalments or by irregular amounts at the discretion of the management, they must be provided for out of gross earnings, and an amount sufficient to cover this charge should be included in the manufacturing cost and in the selling prices.

The customary practice is to estimate the life of the asset and divide this into its cost; sometimes an allowance is made for the expected residual value of the asset when it is discarded.

The sum total of depreciation thus provided on the various items of plant will give the amount to be included in the burden. The more detailed depreciation records kept by some plants will be discussed in Chapter XII.

Taxes

Property taxes and all taxes levied on assets of any kind, all taxes in the nature of license fees, and so forth, should be included as the cost of doing business and added into the burden; the annual tax bills will readily supply the amount. Income taxes, on the other hand, are strictly speaking a charge against surplus, after net profits of the year have been determined but before arriving at the amount available for dividends. It is, of course, understood that a business corporation will endeavor to pass such a tax on to its customers, but there is no point in including it in the manufacturing costs; it is better to take account of income taxes in considering what is a fair margin between total cost and selling prices, when the latter are determined.

Repairs and Maintenance

Two general policies are found in practice for the handling of expenditures for repairs and maintenance: each year may simply be charged for the expenditures which happen to fall there, or an attempt may be made to average these expenditures over a period of years, making the same charge to each year. To carry out the latter method it is necessary only to charge a fixed amount monthly to the repairs account, crediting it to a reserve account; when repairs are actually done, the cost of them is charged to the reserve. This method is more convenient to use in connection with the cost records, since it provides a regular and equal amount to be charged to the various periods. Even if the practice is followed of charging each year with its own expense in the financial accounts, the cost accountant must average the repairs and maintenance expense over a number of years for the purpose of getting a fair amount to include for this item in the burden distribution.

In arriving at the annual expense for repairs and maintenance, it is necessary to make the distinction between items which really are repair charges and items which are properly charges to the reserve for depreciation, or to the plant and machinery account itself. It is often difficult to make this distinction in practice but the broad lines are clear enough; all new units added to the plant and not replacing old machines should be charged to the plant and machinery account; all old equipment retired should, for the amount of depreciation accrued on it, be charged to the reserve for depreciation; all expenditures made to restore machines in a way which cancels depreciation previously recorded will ordinarily be charged to the reserve for depreciation. But all expenditures for repairs and maintenance, which are necessary to keep the plant in good running condition but still do not prolong the life of the various machines beyond what was assumed in computing depreciation, are current manufacturing expenses and must be included in the burden charges.

Insurance

A manufacturing company is likely to carry several kinds of insurance as protection against the calculable risks to which it is exposed. In addition to the fire insurance, there will be the insurance for employers' liability to employees who may receive injury, and use and occupancy insurance, that is, insurance for loss of profits resulting from interruption in the use and occupancy of the premises, as a consequence of fire, flood, or other calamity. Other forms of insurance are found as a protection against special risks, such as damage from boilers, flywheels, or explosives. All these various forms of insurance will involve premiums which should be included in the manufacturing burden; whether they should be grouped together in one total or taken singly will be discussed in the next chapter.

Power

Power expense is something like rent, in that it may consist of monthly amounts paid to power companies for power purchased from them, or it may include the accumulated charges for operating a power plant owned by the business. In the former case the amounts are easy to determine; but in the latter case some amount of recording and analysis is necessary in order to find the total power charges. These will include the fuel consumed in the power plant, the wages of the men engaged in this department, any supplies consumed, and the fixed charges such as taxes, insurance, and depreciation on the power plant. Light and heat expense are very frequently associated with power expense, as they often come from the same source.

Supplies

Supplies include all the indirect materials not included directly in the product itself but used in and about the factory in the course of manufacturing operations; in addition they will include all repair and replacement parts used in maintenance work. In some plants a great variety of packing materials is used, and these are likely to be listed as supplies. A small plant might charge all supplies into manufacturing expense as they are purchased, thus affording a very simple accounting treatment; but it is usually the practice, wherever supplies amount to much money, to keep inventories of them regularly on hand. The records will then show all such purchases added to the inventories, only the amounts of supplies used being treated as expense of the period. This naturally requires that there shall be a system of orders and requisitions for supplies and regular inventory records, just as there are for the direct materials used in manufacturing. The total value of supplies used will then be the amount of burden expense to be dealt with.

Indirect Labor

Broadly speaking, indirect labor includes all labor except that which is employed directly on the product. The characteristic feature of indirect labor is that it cannot very easily be charged to specific jobs or lots of products. Salaries of managers, superintendents, and other executive officers form one class of indirect labor and are usually handled as a separate item in computing the burden expenses. But in addition there are in most factories groups of workers engaged in various ways, who are classed as indirect labor; they include such men as janitors, sweepers, truckmen, timekeepers, clerical workers, and the like. In some cases, as in a foundry, it is difficult to separate the indirect from the direct workers; then it is usual to find a trade custom or practice in the matter. It is necessary only to follow some reasonable practice, and to group the indirect workers into classes which can be clearly understood when it becomes necessary to distribute them to departments or to products.

QUESTIONS AND PROBLEMS

1. The following is the trial balance of the Fairburn Company, makers of small electrical appliances. From this and the other data, prepare:

a. An operating statement which will show clearly the cost of the finished goods manufactured during the period and the cost of the finished goods sold.

b. Ledger accounts to show how the same information would look when posted.

Cash	$ 42,000	
Accounts Receivable	57,000	
Inventories, Raw Materials	26,000	
Work in Process	31,000	
Finished Goods	41,600	
Plant and Machinery	128,000	
Accounts Payable		$ 38,900
Capital Stock		200,000
Surplus		22,200
Raw Materials Purchased	239,500	
Sales of Finished Goods		678,500
Wages Paid	208,400	
Superintendence	23,800	
Rent	16,900	
Taxes	7,500	
Insurance	6,300	
Depreciation	7,000	
Supplies Used	18,500	
Power Charges	9,700	
Administrative Expenses	34,800	
Selling Expenses	41,600	
	$939,600	$939,600

Inventories at the end of the period were:

Raw Materials	$ 25,800
Work in Process	29,400
Finished Goods	46,100
	$101,300

2. In the preceding question, which items do you consider to be included in manufacturing overhead? Explain the source and meaning of each of these items.

3. What was the probable basis of valuation for the inventories given in Question 1 above, as for the end of the period?

4. Suppose that in Question 1 above the Fairburn Company were able to increase its output by 50 per cent without increasing the size of the plant. Estimate how much each item of manufacturing expense would probably amount to for such an output. Explain the grounds for your estimate. Only approximate figures are expected.

5. If you were the proprietor of a manufacturing company, would you for any reason consider it advisable to include in the records a charge or expense for interest on the capital you had invested in the business? If so, explain the reasons for so doing; if not, why not?

6. Why is it necessary to include fixed charges in the costs monthly instead of yearly, or as they are actually incurred?

7. Why do trade associations tend to include interest on investment as a cost in the uniform cost system which they have prepared for their members? Do you approve of this procedure?

8. A cigar company, in maintaining the quality of its product, purchases and stores tobacco two years prior to its use. Should interest on this investment in inventory be considered as part of the material cost when it is charged into Process?

9. How would you handle the fixed expenses upon unused plant and equipment?

10. Why is it that "overhead" is a common topic for discussion among business men?

XI

BURDEN—ITS DISTRIBUTION

Meaning and Purpose of Burden Distribution

Now that all the items of burden expense, as described in the preceding chapter, have been gathered together and it has been ascertained that all manufacturing costs which have not been dealt with as direct materials and direct labor have been included as burden, it is necessary to find some way of charging this burden to the cost of goods produced. The very nature of burden expense means that it applies to many products, many processes, or many departments; the production manager's salary is an expense for all departments, and so are the property taxes paid. If then it is desired to get a cost figure for an individual lot of goods, for a specific operation or department, some part of these general expenses must be included in the computation. It is not possible to find a method of doing this which will be absolutely exact, but there are methods which are reliable for all practical purposes, and which are simple enough to use. It is not necessary to resort to faulty methods in order to be economical.

Need for Departmental Analysis

There is a prevalent belief that the application to prime cost, or to the labor cost, of a blanket percentage addition is a satisfactory distribution of the burden of the entire plant. If the items of burden expense have been carefully assembled and the percentage computed, this method is a distinct improvement over the older methods of either ignoring burden or of "guessing that 50 per cent of labor was about right for burden." Further analysis of this total burden is desirable. Even where there is only one product, as in a cement mill, the management will often wish to know the total cost of operating each department. These figures not only permit of setting up a standard for each department with which subsequent costs may be compared; they may also suggest where investigation and research looking to cost reduction may most profitably be directed.

In factories which turn out a variety of products, it is likely that these products will spend different lengths of time, and require different amounts of attention, in the several departments. This means that correct costs of the products cannot be obtained without computing departmental costs, thus requiring a division of burden items between departments.

In thus allocating burden to departments, the indirect or service departments will receive their respective shares; the power plant, the works offices, the maintenance department, and any similar indirect departments will all receive their due share of the various charges to be distributed. When this distribution has been made, however, the total charges to these departments must be redistributed to the direct producing departments, in order that the entire burden may eventually rest upon the output of these departments.

Object of Departmental Expense Analysis

It is necessary to consider the circumstances in which a distribution of expense to departments may be made. If job costs are to be computed, a burden rate must be worked out in advance, in order that this rate may be applied to the various jobs as they go through. For this purpose it will be necessary to estimate the amounts of the various burden items for the coming period; for many items it will be safe to use the actual figures of the preceding year, but other amounts may have to be modified to agree with present conditions, especially if a changed output is expected. At the end of the period it may be desirable to distribute the actual ascertained burden, for the double purpose of seeing how closely it agrees with the estimates and of considering whether changes are necessary for the succeeding period.

Similarly with process costs, the estimated costs of a coming period may be allocated to the departments, and a unit cost for each department thus computed by dividing its estimated output into the total estimated cost. Later the actual costs may be distributed for purposes of comparison.

Methods of Departmental Distribution

The departmental distribution of burden is made on a sheet resembling Form 35, page 172. Some of the items, like

EXPENSE DISTRIBUTION SHEET

Period Ending

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Total	Expense Items	Power Plant	General Factory	General Office	Drafting Room	Planning Dept.	Tool Room	Pattern Shop	Foundry	Valve Machine	Valve Assembly	Gage Assembly	Gage, Nickel and Buff	Shipping
	Indirect Labor	*Distribution of payroll showing departments in which employed (or in proportion to direct payroll)*												
	Salaries, Administrative	,,		,,	,,	,,	,,	,,						
	Salaries, Superintendents, Foremen	,,		,,	,,	,,	,,	,,						
	Salaries, Clerical	,,		,,	,,	,,	,,	,,						
	Depreciation on Building	*Percentage value of buildings for each department*												
	Depreciation on Machinery	,,	,,	*,, machinery in ,,*		,,								
	Depreciation on Patterns	,,	,,	*,, patterns ,,*		,,								
	Maintenance of Building	*Actual amounts spent on each department*												
	Maintenance of Machinery	,,	,,	,,	,,	,,								
	Insurance, Building	*Percentage value of buildings in each department*												
	Insurance, Machinery	,,	,,	*machinery*		,,								
	Insurance, Compensation	*Proportion to payroll of each department*												
	Taxes on Building	*Percentage value of building for each department*												
	Taxes on Machinery	,,	,,	*machinery in ,,*		,,								
	Supplies, Factory	*Quantities used*												
	Supplies, Office	,,	,,											
	Fuel	,,	,,											
	Water	,,	,,											
	Telephone, Telegraph	*Proportion to payroll, or to total of other expenses*												
	Miscellaneous Expenses	,,	,,		,,	,,								
	Power Plant		*Redistribute according to amounts of heat, light, steam, and power used*											
	Heat													
	Light													
	Power													
	Steam (Test)													
	General Factory		*Redistribute in proportion to payroll or to total of other expenses*											
	General Office		,,		,,	,,	,,	,,	,,					
	Drafting Room					*Redistribute in proportion to payroll or estimated service to each department*								
	Plan Department													
	Tool Expense					,,		,,	,,	,,	,,		,,	
	Pattern Room Expense								*Transfer to Foundry column*					

Form 35: A form for distributing burden to departments.

foremen's or inspectors' salaries, are easily allocated to the departments in which they actually occur; other items, like taxes, fire insurance, and depreciation, are usually computed as a percentage of the plant and machinery and are accordingly distributed to departments in proportion to the value of the machinery in each. Power and supplies should be allocated on the basis of their actual use by the several departments, ascertained by either exact records or approximate estimate. The salaries of general managers must usually be prorated in some more or less arbitrary fashion. No figures are given in Form 35; it is considered more useful merely to indicate the most commonly used basis for distributing each of the items.

Redistribution of Indirect Departments

It will be seen in Form 35 that, on the first distribution of expenses to departments, charges are made to some indirect or service departments which do not directly produce goods but facilitate the production of goods in the direct departments. Since there is no product which can be charged with the expenses of these indirect departments, the amounts already distributed to them must be passed on to the direct producing departments. This is done by a redistribution of expenses on some suitable basis; thus, if on Form 35 the total costs of the power plant were found to be $23,500, this sum would be redistributed to the departments served by the power plant, each department being charged in proportion to the amount of power it used.

Charging the Product

Where process costs are in use, a monthly distribution of burden to the several departments or processes, as described in the preceding chapter, is sufficient; there is no occasion to carry things further unless it is desired to get the costs of individual jobs or lots. When such costs are required, however, it is necessary to work out a suitable rate by the aid of which individual jobs may be charged, as they go through, with a fair proportion of burden. For practical purposes, a burden rate needs to be accurate and yet capable of application to individual jobs with a minimum amount of trouble.

One of the oldest bases, and one still widely used, is the prime cost. After the total burden of a department is ascertained by the process already described, its ratio to the total material and labor costs of that department is ascertained; that ratio is thereafter applied to the material and labor costs of each job in order to get the burden charge for it. The great majority of people who have studied this question, however, believe that in most cases there is no relationship between manufacturing burden and the materials used. Other bases will give far more satisfactory results.

The Time Element in Burden

Most of the items of burden, comprising a large proportion of its total amount, have a very distinct time element in them. Nearly all indirect labor, supervisors, inspectors, floor sweepers, and the like, are paid on a time basis. Depreciation, taxes, and insurance are computed by the year, one-twelfth of the total being charged to each month; the same is true of all rental charges. It is therefore reasonable that any job or product should be charged with burden in proportion to the time which it occupies the manufacturing facilities of the department; in other words, an hourly rate is used.

The next question is whether a man-hour rate or a machine-hour rate is the more appropriate, and the answer is not usually difficult. If the worker is the principal agent of production, as in bench work, or in hand composition in a printing establishment, a labor-hour rate is the better basis for burden distribution. If, on the other hand, machinery and equipment are the principal agents of production, with labor a subordinate expense and consisting essentially of machine tenders, that situation is one in which a machine-hour rate is reasonable and accurate.

Calculation of Hourly Rates

The computation of these rates is a simple matter. The labor-hour rate consists of the total overhead of the department divided by the total number of direct labor hours worked in the department. The resulting figure will, for any one job, be multiplied by the number of hours spent on that job to get its burden charge. To compute a machine-hour rate, the total machine costs of the month should be divided by the total number of hours the machine is expected to run. In a paper mill one paper machine, with the accessory plant, will constitute a whole department; by allocating burden charges to the departments, therefore, the total cost for one machine will be ascertained. If a department consists of a number of similar machines, the total cost of one machine may be computed by dividing the number of machines into the total departmental burden. When, however, the machines within the department are dissimilar, it is necessary to compute the amount of burden properly belonging to each, by methods exactly similar to those followed in distributing burden to the different departments.

Some factory executives object to the machine-hour rate under the impression that it involves too complicated calculation; but while the job ought to be done thoroughly if at all, it need not be very time consuming; and when done once, it need not be done again unless a complete change in the circumstances should take place.

Very often burden may be calculated as a percentage of the direct labor costs, with results practically the same as those of the labor-hour method. Where this is the case, the method is often used because of its simplicity; thus if the total burden of a department is $6,000, and its direct labor total is $10,000, a rate of 60 per cent would be used; then a job with direct labor amounting to $40 would be charged $24 for burden.

Normal Output and Burden Rates

When the total burden costs of a department or machine have been ascertained, the other factor, the number of production hours to be used as the divisor, should receive consideration. Should this number of hours represent maximum production, minimum production, expected production, or an average? The general opinion is that this figure should be a normal or average production which will give a satisfactory profit. If such a figure is used, then the machine or department will completely absorb its burden in a normal period. Many variations are met with in practice, which cannot all be dealt with in the same way. The general principle is that the entire burden of a plant should not always be charged to its product regardless of the degree of activity or the amount of output. To do so may give ridiculous results, and such as can have no practical use. It is desirable to consider the meaning and effect of the figures, and to put them upon a basis which will give wise direction and intelligent information.

Calculation of Burden Rates Illustrated

The methods of computing burden rates and the differences which may arise from different methods are well illustrated by a few typical figures. In the table below, therefore, are given for three separate months, (1) the total operating costs divided into materials, labor, and burden, (2) the quantities of work done, expressed in direct labor hours, machine hours and pounds of product processed, (3) the resulting burden rates computed by the four most common methods in use. In computing the burden rates, small fractions have been ignored, and the nearest round numbers have been used, as would be done in practice.

	January	February	March
1. Materials used	$ 100,000	$ 150,000	$ 180,000
Direct labor	120,000	175,000	220,000
Burden, actual	75,000	80,000	80,000
Total costs	$ 295,000	$ 405,000	$ 480,000
2. Direct labor hours	225,000	330,000	400,000
Machine hours	60,000	100,000	132,000
Pounds processed	1,200,000	1,800,000	2,160,000
3. Burden rates:			
a. Per cent direct labor	62.5%	45%	36.33%
b. Labor-hour rate	33⅓¢	25¢	20¢
c. Machine-hour rate	$1.25	80¢	60¢
d. Per 100 lb. processed	$6.25	$4.44	$3.70

The outstanding facts here are that the volume of production has increased greatly from January to February and March, as indicated not only by the pounds processed but also by the value of materials used and the direct labor charges. The burden, on the other hand, has increased only slightly, as is the usual behavior of the burden in such cases.

Facts on Job B795

The effect of these circumstances is clearly shown by considering the costs of an individual job or lot which might go through this plant in any one of the months under consideration. Let us suppose that the facts concerning this job, No. B795, are as follows:

Direct materials		$ 8.64
Direct labor	17 hr.	14.40
Machine hours	6½ hr.	
Pounds processed	100 lb.	

Every one of these facts may be ascertained by direct observation; the materials figure is the cost of the specific materials issued on a requisition for this particular job; the labor is the actual time and cost of the work of men applied to this particular job, and the machine hours figure is the actual time of a particular machine working on this particular lot. The only uncertainty is the remaining figure, namely, the amount to be charged to this job for general burden.

Burden Amounts Chargeable to Job B795

By using the different burden rates for the different months, as computed above, the amounts of burden to be charged to this one job would be as follows:

	January	February	March
Per cent direct labor	$9.00	$6.48	$5.23
Labor-hour rate	5.67	4.25	3.40
Machine-hour rate	8.12	5.20	3.90
Per 100 lb. processed	6.25	4.44	3.70

Each of these rates has been found by applying the particular burden rate for that month to the base to which it relates. For example, in the first one, $9.00 is 62.5 per cent of $14.40, the direct labor charge to the job. The charge to the job in February, on the machine-hour rate basis, is $5.20, which is 6½ hr. at 80 cents per hour. All the other rates are found in similar manner. It must be understood that in practice only one of these amounts will in fact be charged to this job; but a selection must be made as to the kind of rate to be used and the period and the volume of output on which it will be computed. This calculation of rates is presented to show what wide divergencies may arise by selecting one rate rather than another.

Comments on the Burden Rates

The amount of burden to be charged to this job varies, it will be seen, all the way from $9.00 to $3.40; when added to the material and labor costs, the total cost of the job will vary from

$32.04 to $26.44. One of these many rates must be more nearly correct than the others, and it is the business of the cost accountant to decide which is the best rate. This he does by considering the circumstances and seeing which of his assumptions seem most nearly to fit the case.

It will be seen that each type of rate decreases from January to February and from February to March; this, of course, is the direct result of spreading the burden over an increased output. The only question then remaining is: Which is the most typical or representative output on which the burden rate can be computed? In practice it is usual to use the figures for a longer period than one month, in order to get a rate which is more representative over a period of time.

Then it will help us to consider which type of rate is best if we look at the reasons for the differences among them, taking January as an example. Why do these burden amounts vary from $9.00 down to $5.67 for the same job in the same month, computed by different rates?

The Labor-hour Rate

What, for example, is the reason for the difference between $9.00 and $5.67? The reason is that the average rates paid to labor on Job B975 are a little over 84 cents an hour ($14.40 divided by 17 hr.), whereas for the entire production of January the average hourly rate was only about 53 cents ($120,000 divided by $225,000). If, therefore, the burden rate is calculated on the dollar basis, those jobs which pay high rates will be charged more burden than those jobs which pay low rates. *Per contra*, if burden is charged on an hourly basis, those jobs which take a longer time will be charged more burden than those which take a shorter time. Since this particular job pays high rates for a short time, the burden charge on the dollar basis is much higher than it would be on a time basis.

When it is asked which is the more reasonable, the time basis or the dollar basis, it has been indicated above that usually the time basis is more reliable because most items of burden accrue on a time basis.

Machine-hour Rate

Further, why does the machine-hour rate basis give $8.12 compared with $9.00 on the direct-labor basis? The answer is found in similar observations. For the entire production of January there are 60,000 machine hours, and $120,000 paid to direct labor; for every labor dollar there is ½ hr. of machine time. On Job B795 there were only twenty-three min. of machine time for each dollar of labor (6½ hr. divided by $14.40). The machine time on this particular job was less than the average. The burden charge on this basis will, therefore, be less than that figured on a labor-dollar basis. Again, which basis is the more suitable? The machine hour, like the labor hour, has a time basis and therefore is usually preferable to a dollar rate. Whether the machine hour is preferable to the labor hour depends on the conditions of manufacture. If most of the work is actually done on the machine rather than by hand labor, then the machine hour would be a more suitable rate.

Rate per 100 Lb. Processed

Finally, what is the reason for the difference between $9.00 on the labor cost basis and $6.25 on the basis of the quantity processed? For the entire month of January the average quantity processed per labor dollar is 10 lb. (1,200,000 lb. divided by $120,000). But on Job B795 only 7 lb. were processed per labor dollar (100 lb. divided by $14.40). The ratio of labor cost to quantity produced is much higher on this particular order than the average, so once more the burden amount computed on the labor-dollar basis is higher than that computed on a quantity-processed basis.

Once more then, which is better? If the product were all alike in its handling, we could use the pounds-processed basis, but in that case there would be no such variations as occur on Job B795. The fact that there are such variations indicates that some types of product take more time and cost more money to process than do others; when that is true, allowance must be made for this, and we cannot use a flat charge per 100 lb. processed.

As a net result of all these discussions, it is probable either that the labor-hour or the machine-hour basis is the best of the four methods illustrated; the choice between these two would be decided by the character of the production.

Burden Variations

The problem of over- or underabsorbed burden remains. Taking a simple case: a machine with total overhead costs of $1,000 and, expected to run 250 hr. per month under normal conditions, would have an hourly rate of $4. If, therefore, in a certain month it ran only 200 hr., the total burden charged to production would be 200 multiplied by $4, or $800; a balance of $200 would remain unabsorbed. The reverse situation would occur if the machine ran more than the normal 250 hr. It is now the general opinion that such burden variations should not currently be charged to production but should be accumulated to the end of the period and then dealt with as shown later in this chapter. Variations would also occur if any of the expense items turned out to be different from the amounts which were estimated for them when the burden rate was computed. These burden discrepancies may be of considerable significance and should receive due attention from the factory officers, who should have them analyzed to be sure that they have the situation well understood.

Journal Entries for Burden Distribution

The burden distribution sheet will serve as the basis for a journal entry by which the ledger accounts may record the distribution. The entry must debit the departments with their respective shares of burden and credit the accounts for the several expenses being distributed. The effect of these credits is to remove the expense items monthly from their respective accounts; many people prefer not to do this; they desire to let the original expense accounts accumulate their total annual charges, to facilitate the preparation of the income statement at the end of the year. For this reason they credit an account known as Expenses Distributed for the total amount of expenses charged monthly to the various departments; at the end of the year the actual expense accounts may be closed out by transferring their balances into Expenses Distributed, which also will thereby be closed.

The amounts which are charged to accounts representing indirect departments or services, and which in the burden distribution sheet are redistributed to producing departments, must likewise be credited; the total amount charged to directly productive departments must include these redistributed amounts, so that these direct departments will then carry the entire burden.

Using Form 35, on page 172, as an example, the journal entry for distribution would be as follows:

- Power Plant
- General Factory
- General Office
- Drafting Room
- Planning Department
- Tool Room
- Pattern Shop
- Foundry—Work in Process
- Valve Machine—Work in Process
- Valve Assembly—Work in Process
- Gage Assembly—Work in Process
- Gage Nickel and Buff—Work in Process
- Shipping
    - Power Plant
    - General Factory
    - General Office
    - Drafting Room
    - Planning Department
    - Tool Room
    - Pattern Shop
    - Expenses Distributed

The first seven accounts in each list are the indirect departments; they are accordingly both charged and credited with their share of the burden, thus entering in the ledger a permanent record of these costs. The net result of the above entry is therefore to credit the entire burden expenses of the month to Expenses Distributed, and to charge them to the Work in Process accounts and to Shipping. The latter will probably be regarded as an item of selling expense and will be closed out to Selling Expense account, if there is one, otherwise to Cost of Goods Sold. The departmental Work in Process accounts are the inventory accounts for goods in the course of manufacture.

Ledger Records for Finished Work

At the end of each month the transfers of finished goods from the factory to finished stores will be recorded, in total, in the ledger, by debiting Finished Goods and crediting the Work in Process accounts. The amount to be included in these transfers for burden will be arrived at in various ways, depending on the general cost procedure. If it is a job-cost system, there will be a cost sheet for each job, and on it will be charged the burden applicable to that job; by summarizing these for the month the monthly total may be ascertained. If process costs are being used, it is likely that a unit cost will be worked out for burden, so that the quantity produced during the month, when multiplied by this unit cost, will yield the amount to be credited to the Work in Process accounts and debited to Finished Goods. In any case, some methods must be found of summarizing the quantities of goods finished during the month, and of arriving at the amount of burden chargeable to them.

Unabsorbed Balances in Ledger Accounts

In view of the fact that burden is charged to the product at a standard rate, per unit of product, or per hour, or other basis, there will, as before mentioned, be unabsorbed burden if the quantity of output is less than that on which the burden rate was computed. In the circumstances here described, a full share of burden is charged to the Work in Process accounts, and burden at a standard rate per unit of finished product is credited. If full normal production has been maintained, the balance of the account will exactly represent the amount of work in process inventory at the end of the month; if less than normal production has taken place, the debit balance of the account, after crediting Finished Goods, will include not only the inventory but an unabsorbed balance also, and an adjustment becomes necessary.

To find the amount of this adjustment, it is usually most simple to find the inventory first; the balance of the account, after crediting the inventory, will then represent the adjustment to be made. The account will then appear as follows; materials and labor are here omitted, so that the account is called Burden in Process rather than Goods in Process:

BURDEN IN PROCESS, VALVE ASSEMBLY

Beginning Inventory	$10,000.00	Finished Goods	$23,000.00
Burden of Month	25,000.00	Inventory—End of Month	11,000.00
		Burden Adjustment	1,000.00
	$35,000.00		
Inventory	$11,000.00		$35,000.00

Disposition of Balances

The amount of $1,000, left in the account because production has been subnormal, is now transferred to Burden Adjustment account, which will be carried forward from month to month and at the end of the year closed out to Cost of Goods Sold, after it has been fully analyzed to ascertain the reasons for it. If the adjustment account shows a debit balance, that balance is an addition to the cost of goods manufactured; it means that, by charging a fixed rate of burden to each job, the total amount of burden charged to goods in process has been less than the actual amount of burden expenses incurred during the period. It is therefore necessary to add this deficiency to the cost of goods manufactured. A credit balance in Burden Adjustment account would mean the contrary.

It is then noted that most of the goods manufactured have been sold, though a part remains in stock, as shown in the inventory accounts. Strictly speaking, this debit amount of burden adjustment should be divided between cost of goods sold and inventory of manufactured goods on hand, in proportion to their respective amounts. But if, as is usually the case, the amount sold greatly exceeds the inventory, it is common to charge the entire amount of the burden adjustment into the cost of goods sold for the period as stated above. On the other hand, where the inventory is large compared with cost of goods sold, it might be considered desirable to add a proportionate part of the unabsorbed burden to the value of the inventory.

But this would raise another question. Under this method, the less work was turned out, the greater would be the value per unit of the inventory, because the burden would be spread on a smaller quantity of goods. Care should be taken not to exaggerate the value of the inventory unreasonably; in fact this is another reason why it is desirable to charge to the inventory only the standard burden rates, and to charge any unabsorbed balance to cost of goods sold.

When Burden Distribution Sheets Are Prepared

If standard burden rates are to be set, in order that they may be charged to jobs which will go through the plant during the coming year, then a burden distribution sheet must be prepared in advance, using the estimated expenses of the year to be covered. To obtain these estimated expenses, the actual expenses of previous years will be examined and adjusted for all known or expected changes; the normal output will then be divided into the departmental totals thus obtained, and the results will be the rates to be used.

At the end of each month a distribution of actual burden may be prepared, for the purpose of giving the amounts chargeable to the various departments, as shown above. In this, of course, the actual expenses of the month will be used, as closely as they can be ascertained.

Occasion will be taken at this time to compare the actual burden figures of the month with those estimated at the beginning of the year, and to explain all considerable differences.

QUESTIONS AND PROBLEMS

1. The trial balance of the Balfour Machine Company was as follows on December 31, 1928:

Cash	$ 32,000	
Accounts Receivable	40,000	
Inventory Finished Goods	46,000	
Inventory Raw Materials	39,000	
Materials in Process	23,000	
Labor and Burden in Process	18,000	
Plant and Machinery	172,000	
Accounts Payable		$ 37,000
Capital Stock		125,000
Surplus		27,000
Sales		1,384,000
Cost of Goods Sold	1,127,000	
Burden Adjustment		3,500
Selling and Administrative Expense	79,500	
	$1,576,500	$1,576,500

The Burden Adjustment account appeared in the ledger as follows:

BURDEN ADJUSTMENT

Jan. 31	Lab. & Burd. in Proc.	$ 800.00	Mar. 30	Lab. & Burd. in Proc.	$4,900.00
Feb. 29	Lab. & Burd. in Proc.	1,300.00	May 31	Lab. & Burd. in Proc.	5,300.00
Apr. 30	Lab. & Burd. in Proc.	1,600.00	Oct. 31	Lab. & Burd. in Proc.	7,400.00
June 30	Lab. & Burd. in Proc.	1,400.00			
July 31	Lab. & Burd. in Proc.	1,100.00			
Aug. 31	Lab. & Burd. in Proc.	3,700.00			
Sept. 30	Lab. & Burd. in Proc.	1,800.00			
Nov. 30	Lab. & Burd. in Proc.	2,400.00			

a. The foregoing trial balance does not show any accounts for manufacturing labor and expense; explain what has become of these.

b. Physical inventories were taken on December 31, and were found to be:

Finished Goods	$46,000
Raw Materials	39,000
Materials in Process	23,000
Labor and Burden in Process	16,500

Why do the first three of these inventory figures agree with the trial balance, and why does the fourth disagree?

c. What is the journal entry by which the Labor and Burden in Process account should be adjusted?

d. What is the meaning of the Burden Adjustment account?

e. When the books are closed, what will be done with the balance in Burden Adjustment?

2. In the machine shop of the Balfour Machine Company the following facts were noted:

	Entire shop	Job 285
Materials Entered into Process	$15,000	$120
Direct Labor	$12,000	$110
Direct Labor Hours Worked	16,000	150
Burden Expenses	$14,400	
Hours of Machine Operation	18,000	175

Compute the amount of burden chargeable to Job 285 by four different methods. Which of these methods do you think would be best?

3*a.* The M E F Manufacturing Company distributes burden by using man-hour departmental rates, determined at the close of each month.

Last month, the rate for department F was almost double that of the prior month and the president of the company claims that an error has been made.

The cost accountant says that he has determined the rate as usual and that his computations are correct.

You are called in to investigate and you discover that one-half of the machines in the department were idle during the greater part of the period, which accounts for the increase in the burden rate.

The president expresses his opinion to you that the cost accountant is confusing "cost" with "loss."

Discuss the matter and explain, briefly, your conclusions.

b. The plant of the Atlas Manufacturing Company is made up of six buildings, on one site, in the town of P.

Burden is distributed by using the "predetermined-machine-hour rate method."

A machine, numbered A-2-34, has a burden rate of $0.2146 per hour, on the assumption that the center should operate 2,000 hours in the current year.

Explain, as fully as possible, giving schedules, how the rate is determined, assuming that steam power is used and that light and water are purchased.[1]

4. You are requested to make a balance-sheet examination as at December 31, 1926, of the A Company, engaged in the manufacture of machinery.

During your examination, you are informed that the inventory has been valued at cost, as reflected by detailed job-cost records on file. A study of the job-cost system, under which the inventory has been valued, indicates that factory burden has been absorbed in costs as a percentage of direct labor. The company's operating accounts tend to show that a considerable balance of unabsorbed factory burden has accumulated during the year, in spite of the fact that the plant was operated to capacity during the entire calendar year 1926.

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[1] American Institute of Accountants, May, 1928.

a. What are your conclusions regarding inventory valuation based upon the information cited above?

b. What adjustment, if any, would you make in the total valuation of the inventory at December 31, 1926?

c. If an adjustment in inventory valuation were necessary, how would you make it?[1]

5. You are required to make a financial investigation of a large machine plant engaged in the manufacture, to order, for the trade, of tools, jigs, etc., for the five years ended December 31, 1924. In the course of your examination of the charges to the fixed asset accounts for the period, you find that practically all the additions to fixed assets for the five years have been made in the company's own shops as these additions consist principally of dies, jigs, patterns and similar machine equipment.

No additions to the real estate or buildings of the company were made during the five years.

During the examination you elicit from the company's books the data set forth in the following tabulation:

Year	Net Profit from Operations	Additions to Fixed Assets	Factory Overhead Charged to:		Percentage of Idle Time (normal Percentage 20 %)	Percentage of Overhead to Productive Labor
			Operations	Fixed Asset Accounts		
1920	$270,000	$25,000	$200,000	$10,000	18	98
1921	50,000	50,000	120,000	27,000	38	180
1922	105,000	35,000	175,000	15,000	23	105
1923	225,000	13,000	225,000	5,000	17	90
1924	90,000	44,000	135,000	25,000	41	200

Discuss fully the problems to be considered involved in your verification of the charges to fixed asset accounts for the five years, and if there is any division of opinion among accountants in theory, as to the propriety of any of the elements of these charges, present both viewpoints. Indicate, without using figures, the nature of the adjustments, if any, that you would make in view of the disclosed facts.[2]

6. A company, engaged in the manufacture of piece goods, had no cost system. Its sales were made on the basis of estimated costs, adding 15 per cent to estimated direct cost to cover overhead, then adding to the total so estimated a profit equal to 12 per cent of the selling price.

At the end of the year 1927, the trial balance was as follows:

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[1] American Institute of Accountants, May, 1927.

[2] *Ibid.*, November, 1925.

Buildings	$ 276,000	
Machinery	310,000	
Spools and Other Similar Items	33,000	
Accounts Receivable	110,000	
Accounts Payable		$ 27,000
Reserves for Depreciation to January 1, 1927—		
Buildings		36,000
Machinery		71,000
Sales		2,013,000
Inventory—January 1, 1927	157,000	
Purchases—Raw Material	1,200,000	
Labor—Direct	480,000	
Labor—Foremen, etc.	213,000	
Office Payroll	76,000	
Factory Expense	280,000	
Office and Administration Expenses	113,000	
Capital Stock		1,000,000
Cash in Bank	18,000	
Surplus—January 1, 1927		119,000
	$3,266,000	$3,266,000

An estimated cost, which may be taken as representative of all the estimated costs, was as follows:

Cost per yard:	
Raw material	$ .89
Weaving—piece-work	.38
Winding, warping, etc.	.03
Foremen and supervision	.10
	$1.40
Factory and office overhead—15% of $1.40	.21
	$1.61
Profit—12% of $1.83	.22
Selling price per yard	$1.83

Inventories were principally of raw material and for the present purpose may be considered as consisting entirely of raw material at cost. The inventory at December 31, 1927, was valued at $376,000.

The rate of depreciation on buildings was 2 per cent and on machinery, 7½ per cent; spools, etc., were not distributed; replacements were charged to operations (factory expense).

Before the books were closed, it was realized that a heavy loss had been sustained. Suggestions were made—a defalcation, material stolen, etc.

What was the amount of the loss and to what do you ascribe it? Indicate briefly what is needed to prevent a repetition of such conditions.[1]

7. The Maverick Machine Tool Company made all its products to special order and kept job order costs. The following items include all the accounts relating to manufacturing which appeared in the trial balance for October 31, 1931:

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[1] American Institute of Accountants, November 1928.

	Dr.
Raw Materials Inventory, Oct. 1, 1931	$ 96,000
Work in Process Inventory, Oct. 1, 1931	37,500
Raw Materials Purchased	135,000
Direct Labor	177,500
Manufacturing Expense	99,000

During October, requisitions of raw materials for process totaled $108,500.

At the end of October the work orders completed during the month were summarized, and so were the work orders still in process; the figures showed:

	Work orders completed	Work orders in process
Materials	$ 70,000	$ 45,000
Labor	142,000	41,500
Burden: 140,000 hr. @ 50¢	70,000	
40,000 hr. @ 50¢	....	20,000
	$282,000	$106,500

Prepare the Work in Process ledger account for October.

Explain as far as possible the causes of the apparent lack of balance in the account. Show the account duly closed.

8. Operations at the Webster Mills were summarized quarterly and at these times the actual burden was distributed to the various departments. For purposes of this distribution a burden distribution sheet was used.

The following table shows the departments of the company and the percentages that were used in distributing the burden to them when direct allocation was not possible.

BURDEN DISTRIBUTION

Department	Payroll, per cent	Power, per cent	Value of space and machinery, per cent
Picking and Carding	20.60	23.10	24.10
Spinning	26.40	50.10	27.60
Spooling and Warping	7.10	1.30	5.30
Dressing and Drawing in	3.50	0.80	2.70
Weaving	38.90	24.10	37.20
Cloth Room	3.50	0.60	3.10
Total	100.00	100.00	100.00

The first step was to summarize the expenses into five groups as follows:

Group I. General Expense, which included Administrative Expense (administrative salaries chargeable to the mill).
Group II. Fixed Expenses, which included:
  Interest.
  Taxes.
  Insurance.
  Depreciation.
Group III. Power.
Group IV. Repairs.
Group V. Supplies.

The expenses for the quarter are given below by groups, condensed to simplify the detail of the problem. In actual practice each item of expense would be given; under the heading Accounting, for example, might appear items such as salaries, supplies, equipment, telephone, and miscellaneous.

GROUP I.—GENERAL AND ADMINISTRATIVE EXPENSES

Subsidiary Account	Total All Charges
A. Accounting	$ 4,403.33
B. Transportation	7,119.89
C. General Mill	8,508.48
D. Miscellaneous	2,571.51
E. Administrative	14,250.12
Total	$36,853.33

GROUP II.—FIXED CHARGES

Subsidiary Account	Total All Charges
Interest	$21,114.15
Taxes	30,000.00
Insurance	8,250.00
Depreciation	37,500.00
Total	$96,864.15

GROUP III.—POWER

Subsidiary Account	Total All Charges
A. Water	$ 739.98
B. Electric	39,877.48
C. Steam Plant	17,622.14
D. Heating	1,438.70
Total	$59,678.30

GROUP IV.—REPAIRS AND MAINTENANCE

	Subsidiary Account		Total All Charges
A.	Buildings (allocated on basis of space per cent)		$ 3,858.71
B.	Mill Machinery (allocated directly to departments):		
	1. Picking	$1,224.52	
	2. Cards	567.45	
	3. Roving	355.69	
	4. Spinning	1,083.33	
	5. Spoolers	55.06	
	6. Warpers	27.39	
	7. Slashers	743.83	
	8. Drawing-in Machinery	129.36	
	9. Looms	1,629.60	
	10. Cloth Room	261.54	
			6,077.77
C.	Mill Equipment (allocated on basis of space per cent)		544.17
D.	Transmission (allocated on basis of power per cent)		17,158.45
E.	Supervision (allocated on basis of space per cent)		1,460.20
	Total		$29,099.30

GROUP V.—SUPPLIES

	Department	Total Charges
A.	Picking and Carding	$ 2,391.73
B.	Spinning	6,834.79
C.	Spooling and Warping	403.53
D.	Dressing and Drawing in	15,433.80
E.	Weaving	13,612.86
F.	Cloth Room	4,615.50
	Total	$43,292.21

The bases for the distribution of the expense groups to the departments were as follows:

Group I. Divided proportionately to payroll.
Group II. Divided proportionately to value of space and machinery.
Group III. Divided as follows:

Power charges for the quarter:	
Electric power (allocation basis, power per cent)	$39,877.48
Steam for slashers (charged direct to dressing yarn)	2,292.50
Balance of charges (allocation basis; space per cent)	17,508.32
	$59,678.30

Group IV. Divided proportionately to space occupied, direct, power
Group V. Direct.

a. Prepare a burden distribution sheet using the foregoing information.

b. Prepare a journal entry or entries to incorporate the distribution sheet in the ledger.

9. What are the various steps in accumulating and distributing burden?

10. Of what use is the burden distribution sheet?

11. What is meant by, and what are the differences between, actual burden, estimated burden, standard burden, and budgeted burden?

12. What are the meaning and purpose of burden rates? State briefly how they are computed.

XII

DEPRECIATION AND DEPRECIATION RECORDS

Meaning of Depreciation

Depreciation is one of the most important items in the cost accounts, and one most liable to be misused. Depreciation is the loss arising from the wearing out of fixed assets such as plant and machinery, buildings, furniture and fixtures; this wearing out may be an actual, physical deterioration of the property, or it may be "functional" depreciation caused by the fact that other machines have been invented which render the present machine obsolete for the purposes for which it has been used. For these or other reasons all machinery will some day be discarded, and depreciation is an attempt to record the progress of equipment towards that inevitable end.

It is essential that records should be kept of depreciation from two points of view: (1) to record the decrease in the book value of the assets arising from this cause, and (2) to include a proper charge for depreciation in the cost figures, which are incomplete without such a charge.

Depreciation is one of the most disputed subjects in the whole field of accounting. Some people have contended that it is not necessarily a cost of the current period because no cash is disbursed; others have argued that the asset valuations arrived at by the common methods of recording depreciation are meaningless, since they have no necessary relation to market values. It has been stated by an official of the Internal Revenue Department that one-eighth of the disputes between the Department and taxpayers concerning the determination of taxable income, relate to questions of depreciation; the Department is constantly seeking to establish a better working agreement on the subject of depreciation rates and policy.

Depreciation Based on Former Outlays

As to the first point mentioned above, that no cash is disbursed, it may be stated that cash *has been* disbursed; when the machine or other asset was purchased, cash was in most cases paid for it. That cash payment is a cost of the period during which the asset renders its service, though this period usually covers several financial years; the only reasonable thing is that each of these years should bear its proportionate share of the total cost of the asset. Any other procedure results in one or more years being unduly burdened with this cost. One purpose of depreciation accounting is, therefore, the prorating of the cost of an asset over the term of its useful life so that each period shall bear its proper share. In no other way can the costs of the several periods be so accurately and fully stated, and the idea that depreciation may be recorded in prosperous seasons and neglected in bad seasons is erroneous from a cost accounting point of view and is unsound financially.

Causes of Depreciation

As already mentioned, the two main causes of depreciation are the physical wearing out of the equipment and the chances of obsolescence arising from the progress of invention in the industry. In addition to these must be mentioned inadequacy of the equipment; even without new inventions, the business itself may have grown to a point where the existing equipment is too small or too limited in capacity, and where it is impossible or uneconomical simply to add new units; the old equipment must be scrapped to give place to completely new and larger units.

In practice every variety of combination of these several causes may be found. In some industries it is customary for equipment to be used as long as it will hold together and operate; parts may be replaced from time to time, but with that much maintenance machines may operate for thirty, forty, or more years; in the textile and printing industries instances of this are not uncommon. In other cases, in the electrical industry, for example, equipment is scrapped because of obsolescence more often than because it will no longer work; in machine-tool construction also progress has been sufficiently rapid for many machines to be discarded long before they were worn out. In the absence of obsolescence it is clear that a piece of equipment may be made to function almost indefinitely by constant repair and replacement of its parts; in the plant accounts there is always a tendency for the capital value of such equipment to disappear before the machines have in fact ceased to operate.

Computing and Recording Depreciation

The general method of computing depreciation is to estimate the service life of the asset and to divide that service life into its total cost. Strictly speaking, the residual value of the machine when it comes to be discarded should also be estimated and deducted from the total cost, since it is the difference between the new and the residual value that is the true cost of the period. Since this residual value is usually small, however, and the whole computation is largely an estimate, this remainder is in practice often ignored.

The question arises whether this total cost should be allotted equally to the various years of the life of the asset or depreciation should be recorded more rapidly in the early years of its life and less rapidly later or a reverse method should be used. In practice, probably 95 per cent of all businesses use the straight-line method; that is, they charge the various periods equally. Other methods involve considerably more trouble and have no very obvious advantages. On the contrary, if it be assumed that the asset serves all years alike, the reasonable thing is to charge them all equally. This method is commonly referred to as the "straight-line" method of depreciation. When in this way the amount of the yearly depreciation has been ascertained, one-twelfth of this sum will be charged each month into the cost of operations, by means of a journal entry. The debit is to Depreciation, which in turn is included in the general burden and transferred into the Manufacturing account. The credit is to Reserve for Depreciation, which is equivalent to a credit on the plant account itself, since it serves as a record of the reduced or expired value of the plant because of depreciation. In the balance sheet the best way to present this reserve is to show it on the assets side as a direct deduction from the value of the plant; it is often placed on the liabilities side, but there it is likely to mislead many as to its true nature.

Variations from Straight-line Depreciation

One variation of the straight-line method is to use not the life period but the output or production of the asset, as a basis of computation; in that case the economic idea that the value of a capital asset gradually becomes embodied in the value of the goods which it produces is given recognition. The idea may be expressed briefly: assume that a machine which cost $800 will have a useful life of 10 years and is expected in that period to produce 40,000 articles. Then, instead of charging $80 per year for depreciation, the charge might be $\frac{\$800}{40{,}000}$ = 2 cents per article, and the annual charges might be figured thus:

	Production, articles	Depreciation charge
First year	5,000	$100
Second year	3,000	60

It has the merit of charging each year in proportion to the benefits actually derived from the equipment during that year; it cannot be said, however, that this necessarily represents the depreciation of the year; causes other than the direct use of the equipment may have contributed to hasten the end of its useful life. There is high opinion for charging depreciation in the steel industry on the basis of the number of tons produced each year.

Sinking-fund Method

Another variation, or group of variations, from the straight-line method arises when interest is taken into the reckoning; several different series may be developed by applying compound interest to the annual payments. This is sometimes done where the emphasis is placed upon the idea of building up a fund to replace the assets when they are worn out or discarded. It is then considered that the annual depreciation charge will be an amount including two items: (1) the annual addition to the fund, and (2) the interest earned on the fund during the current year. Because these interest earnings will increase year by year, the total annual provision will likewise increase. The method is known as the sinking-fund method and may be illustrated briefly thus:

Cost of asset, $500; expected life, six years; rate of interest on sinking fund, 6 per cent.

The question may then be stated in simple form: what annual sum, accruing interest at 6 per cent, will amount to $500 in six years? By the use of algebraic formula, or more commonly in business by reference to bond tables, it is found that the required annual sum is $71.68. The depreciation table for the whole life of the asset then is:

Year	Fixed annual sum	Interest earned for year	Total-depreciation provision for year
1	$ 71.68	$ 0.00	$ 71.68
2	71.68	4 30	75.98
3	71.68	8.86	80.54
4	71.68	13.69	85.37
5	71.68	18.82	90.50
6	71.68	24.25	95.93
Total..........	$430.08	$69.92	$500.00

The last column then shows the amount of the depreciation charge for each of the six years. The plan is based on the thought that one object of depreciation accounting is to provide that at the end of six years, when the asset is worn out, the business will be in possession of the sum of $500, the original cost of the asset. It is immaterial whether or not the managers use the $500 to buy a similar or other asset; the point is that their invested capital is thus maintained whole and undiminished.

Annuity Method

Another form of interest table is used when it is considered that the depreciation accounting should return to the business not only the original investment but also an income of 6 per cent (or other desired rate) on the net value of the asset. The table then is:

	(*A*)	(*B*)	(*C*)	(*D* = *A* + *C*)
Year	Amount required for capital	Balance of investment	6 per cent interest on balance	Total depreciation charge
1	$ 71.68	$500.00	$ 30.00	$101.68
2	75.98	428.32	25.70	101.68
3	80.54	352.34	21.14	101.68
4	85.37	271.80	16.31	101.68
5	90.50	186.43	11.18	101.68
6	95.93	95.93	5.75	101.68
Total..	$500.00	....	$110.08	$610.08

It will be seen that column *A* is identical with the last column in the previous table; the total is $500, so that the annual sums there listed are sufficient to furnish a reserve, by the time the asset is retired, equal to the original investment in it. But in addition it is desired to charge against income 6 per cent interest on the reducing balance value; these charges are shown in column *C*, and the total in column *D*, which thus gives an equal charge to each year. The record for the first year, for example, would be:

Depreciation Expense	$101.68	
Reserve for Depreciation		$71.68
Interest Income		30.00

If objection were raised to charging the whole amount as depreciation expense, the record might be made in the form of two entries, thus:

1. Depreciation Expense	$71.68	
Reserve for Depreciation		$71.68
2. Interest Charged to Cost	30.00	
Interest Income		30.00

This makes the depreciation charge the same as under the sinking-fund method, accompanied by a charge for interest on capital invested. As stated in the discussion of this matter on page 195, however, when such a charge is made, it is usually computed on the basis of the original investment and not on the reducing balance.

Depreciation and Rate of Operation

But one other departure from the straight-line method of computing annual depreciation may be noted. In estimating the useful life of machinery it is necessary to assume normal conditions; for example, that it will be used 9 hr. a day, and that it will be possible to stop for repairs when repairs are necessary. If different conditions should arise, such as were found so frequently during the war, when machinery was often run 20 or 24 hr. a day and time was not taken to give it proper attention, it is clear that the original estimate of the life of the plant was likely to be overstated. In these circumstances some concerns worked out tables showing depreciation varying with the rate of operation per day. One well-known steel mill estimated that certain plant assets would last for 10 years operating 10 hr. per day, but it was estimated that they would not last more than 5 years at 24 hr. per day, so that the depreciation rates had to be doubled. This method is very similar in effect to that described above, where depreciation is figured on the output basis.

Useful Life-experience Tables

Studies have been made for determining the useful life, and therefore the appropriate rates of depreciation, by collecting general experience statistics for different types of equipment. The idea here is to regard wasting assets as the life insurance tables regard human beings; if figures about human life can be gathered in the form of mortality tables, covering a sufficiently wide area and number of instances to be representative, then we have all the necessary data for an insurance plan, including the computation of premiums which will suffice to meet all losses. The same sort of data, it is contended, about the causes for which machinery is discarded and its life terms in sufficient abundance and variety of circumstances will enable us to compute depreciation rates on a sound basis.

We cannot know too much about this subject, and all such fact-finding studies will be helpful to the individual business looking for guidance and to the general social study of business. But it will still be necessary for the individual business to ascertain its own position on the general scale thus set up. It has not yet been possible to adopt any sort of insurance scheme whereby machinery losses by retirement might be distributed evenly among all business, as is done, for example, with fire losses. Each company must be prepared to meet its own asset replacements when they occur; the circumstances of each company are peculiar in many respects, and, while the general experience may be helpful, there is no way of averaging any one company's losses with those of another. It seems unlikely, therefore, that general experience tables on machinery can be followed very literally by the individual company, which will be forced to take into account mainly the circumstances of its own case in estimating the life periods of its various assets. In a very large company, owning many assets, the tabulations of useful life of their own units would furnish a just basis for depreciation rates.

Depreciation and the Income Tax

Reference has been made to the highly contentious nature of depreciation as a factor in the computation of income for tax purposes. The law provides only that a "reasonable allowance" shall be made for this factor; and the Board of Tax Appeals, following many court decisions, has ruled that this "reasonable allowance" must depend upon the facts of each case, so much so that in some instances it has rejected a straight-line, or equal annual instalment, method of computing depreciation in favor of a method in which allowance was made for the varying output of different years.

The Commissioner of Internal Revenue has, nevertheless, sought to encourage some uniformity of practice within individual industries; while admitting that different conditions might justify different rates of depreciation for different companies in the same industry, he contends that in the absence of such different conditions the rates within an industry should tend to some uniformity. The members of the various industries have, therefore, been urged to get together, through their trade associations, and to agree upon average rates which the Commissioner may use as a guide.

The Bureau of Internal Revenue regards an investment in depreciable properties as a prepaid operating cost; the original cost of the property is therefore the measure of the amount which may be recovered through depreciation. All depreciation allowances claimed in income tax returns must be recorded as depreciation provision in the taxpayer's books, and the amounts should be computed upon specific items of property and not as general or blanket rates on all property, if they are to satisfy the Bureau. In other words, a plant ledger is recognized by the Bureau to be strong supporting evidence of the amounts claimed for depreciation.[1]

Separate Provision for Obsolescence

So far obsolescence, and ordinary depreciation arising from wear and tear, have been spoken of together, and this probably represents the practice in the majority of cases. In the federal income tax law itself depreciation is defined as "including a reasonable allowance for obsolescence."[2] In many cases, however, it is desirable for business reasons, and necessary for tax purposes, to make a separate item when unusually rapid depreciation takes place on account of obsolescence. While the general principle is that the total cost of the asset shall be absorbed within its useful life, yet it is also part of the principle that this charge shall be spread over that period as evenly as possible. If the obsolescence has been anticipated and has been included within the ordinary depreciation charges, so that the entire cost of the equipment unit has been written off by the time it has been superseded, then no particular problem arises. The difficulty comes when obsolescence occurs suddenly or with such rapidity that a large balance remains unamortized in the Equipment account when the unit is abandoned. The precise treatment of this balance in the records will depend upon the size and the amount relative to other values in the business. If it can be charged in the year when it occurs without distorting the results of that year, it is undoubtedly best to get rid of it in that way. If it is large enough to affect the results materially, it is better first to show the Net Profits before this charge and then to deduct the unusual charge from Profit and Loss as a special item or, better still, to charge it to Surplus. Nor should the amount be permitted to get into the computations of current costs for price-making purposes.

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[1] See Regulations 77, by the Treasury Department, Article 209.

[2] Revenue Act of 1932, Section 23k.

Obsolescence for Tax Purposes

The Internal Revenue Department has been conservative in regard to allowing separate or special deductions for obsolescence, though they recognize obsolescence as an element in the regular depreciation rate. Thus, if an asset would physically last for 40 years, but it is estimated on good grounds that it will be obsolete at the end of 15 years, then a rate of 6.66 per cent depreciation would probably be allowed as "including a reasonable allowance for obsolescence." What the Department is most suspicious of is sudden jumps in the annual amounts of depreciation or obsolescence. In the foregoing case, for example, suppose at the end of nine years, when 40 per cent of the value of the asset would remain undepreciated, that the management concluded they would have to discard it at the end of another two years and wished therefore to charge off 20 per cent depreciation at the end of the next or tenth year. They might be able to furnish to the Department convincing evidence of their definite intention to abandon the unit at the end of the eleventh year and so secure their allowance; but for the most part it would be the attitude of the Department that the company should go on using their 6.66 per cent of depreciation and then take the full extra depreciation only when the unit had been actually abandoned, and the extra loss was established and its amount known. This sort of thing would, of course, not apply to small items causing only small additions to the depreciation charges, but any large increases would be critically scrutinized. The management, however, need not be deterred from setting up on their books and in their statements a larger amount of depreciation than is allowed by the tax authorities; to do so may be only reasonable prudence.

Book Cost or Reproduction Value as the Base

For the most part it has been assumed that the *cost* of the asset is the amount which will be used in figuring the annual charge to be included in costs. This is the principle followed in financial accounting, where one of the main purposes is to show the progress of the equity of the present owners, and how far their original equity has been recovered through depreciation.

But in speaking of depreciation as a factor in costs, we are thinking of the company's plant as a unit in the industry, producing goods under the competitive conditions of the present. It does not follow that the original book cost is the logical basis for this purpose. This is made especially clear when we think of the circumstances under which the book cost was arrived at. By no means does it always represent a cash outlay by the present owner; but, among other things, the book value may be (1) a value set upon the assets when the present owner inherited them or (2) a value arrived at on the basis of the amount of securities issued in exchange for the assets or (3) a value put upon them for merger purposes, even though no securities were exchanged. These conditions may result in highly artificial values which have no relation to present conditions. Even when cash has been paid, the assets may have been bought at a distress sale, at very low values. In such circumstances it is common to figure depreciation, as a factor in current costs, on the present replacement cost of the properties, even though in the financial accounts, and for income tax purposes, depreciation may be computed on the book costs. If the cost system is not tied in with the financial books, no difficulty arises from the discrepancy; if the cost system is tied in, the excess of actual depreciation taken as a charge to operations, over that figured on book cost, must be treated as an additional credit to Profit and Loss, like any other item of overabsorbed burden.

Depreciation on Reduced Values

During the last three years the question of the value on which depreciation should be computed has taken the reverse turn from that discussed in the preceding paragraph. Values have not increased but have substantially decreased since a great many fixed assets now in use were purchased and installed. So great has been this decline that many industrial companies have written large amounts off their plant accounts, not only reversing previous increases in the value but also writing large amounts off actual cost values. The purpose of this has been not only to show balance sheet values more in line with current conditions but also to relieve the annual operating statements of the heavy charges involved by the former high values. If a company has been charging 10 per cent depreciation on a plant valued at $3,000,000 and reduces that valuation to $2,000,000, the annual depreciation charge is reduced from $300,000 to $200,000. In addition steps are usually taken to secure reductions in the insurance and property tax expenses, though the latter, of course, are dependent upon the assessments of the local taxing authorities.

Example of General Motors

The wisdom of this policy must be judged by the facts of each case. It must be noted that, though writing down the assets results in a conservative balance sheet, the effect on the income statements of smaller depreciation charges is the opposite of conservative practice. One of the most satisfactory handlings of this problem appears in the 1932 report of General Motors Corporation, where it is shown that Plant and Reserve for Depreciation were each written down by some $93,000,000, because this step reduced unused plant capacity down to its salvage value, and because the Reserve for Depreciation was ample to take such a charge. It was further intimated that, whenever any of this unused plant should be used again, its value would be put back into Plant account, and depreciation on it charged to Operations. This is sound policy, since it means that all production would be charged with full depreciation on plant devoted to it, which should always be the case.

Reserve for Depreciation

The precise nature of the reserve for depreciation is often misunderstood. Sometimes it is confused with actual funds destined to be used for the replacement of worn-out assets; but since it appears either on the liabilities side of the balance sheet, or as a subtraction on the assets side, it cannot and does not refer directly to any fund. Still oftener is it confused with appropriations of surplus, made for the purpose of earmarking or withholding from distribution to stockholders such portion of the earned surplus as it may be considered desirable to retain permanently within the business. But since the reserve for depreciation was set up to provide for an actual loss arising from the wearing out of equipment, it cannot be any part of surplus; in fact, several of the most prominent writers recommend that the title "allowance for depreciation" be used instead of reserve, to emphasize the fact that its principal significance is to indicate a deduction from the value of the plant assets.

Reserved Out of Gross Income

In providing depreciation there is a reserving or withholding from gross income of an amount equal to the estimated loss from the wearing out of the assets, and this fact will result in other assets being retained in the business instead of being regarded as net profits available for distribution. These other assets are first in the form of current assets, being cash collected from sales. But the cash itself is not segregated; it remains with the general cash funds; and since it is not wanted immediately for buying materials, or paying labor, or even for replacing old and discarded equipment, it is often used for buying additional equipment. In that case, suppose the plant items appear in the balance sheet thus:

Plant and Machinery	$240,000	
Less: Reserve for Depreciation	50,000	$190,000

Then it is quite likely that the plant inventory includes old and depreciated equipment of a cost value, say, of $190,000, and of $50,000 worth of practically new equipment, as yet undepreciated but purchased out of funds provided in the business by the depreciation reserve. As a matter of fact some companies regard their reserve for depreciation definitely as a source of new money for purchasing additional equipment. And although the original assets of the business have largely depreciated, yet the capital of the business remains unimpaired because the new additions supply the deficiency, even though physically the new assets may have no connection with the depreciated assets but may perform entirely different operations. The reserve for depreciation therefore measures the expired portion of the original cost of the assets and also indicates that the loss has been made good out of the gross income of the business.

Example of Pullman Company

In a discussion of Pullman, Inc.,[1] it was stated in effect that, although they were not currently earning profits in adequate amount, yet they were enabled to go on paying dividends because of their depreciation reserves. This is an interesting statement which is perfectly valid if fully understood, but several missing steps must be inserted in the argument before it is quite clear. The complete statement would run somewhat as follows:

1. To make dividends legal, profits must have been earned; a large surplus in the company's balance sheet showed it had earned profits in previous years and still had them in the business.
2. The next thing necessary for the payment of dividends is the required amount of cash. The company's statement was in substance that, though current profits did not furnish this cash, the reserve for depreciation did. The question is whether this is true, and how it comes about.
3. The statement is true, and it comes about thus:
4. The company would doubtless compute its costs of rendering service, including a proper amount for depreciation.
5. These costs would be embodied in actual charges to customers, and, provided business was in sufficient volume,

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[1] Circular of Clark, Dodge & Co., March 27, 1933.

actual cash revenue would come in, large enough to cover all the costs, including depreciation.

6. Out of these cash revenues would first be defrayed all the cash costs, such as wages, supplies, and so forth.

7. This would still leave in the company's hands the cash corresponding to the depreciation reserves.

8. The depreciation accounting shows that this cash is not net profit and is not ordinarily distributable; it is usually needed (*a*) to purchase replacements of retired plant, (*b*) to purchase new or additional plant.

9. In the Pullman case they did not require this cash for either of these purposes, so they regarded it as available for dividends, the legal basis for such dividends being assured as in Item 1 above.

Book Values and Market Values

As to the relationship between depreciated book values and market values, it is not the business of the financial accounts to record market values of assets or the changes in them. The average business is not for sale on the market but intends to carry on as a going concern. To such a concern the books should show (1) how much was invested in the asset; (2) how much has been written off and charged to operating expenses; (3) the residual value, which represents the unrecovered investment which the business still has in that asset, and which it must in future years charge into operations if it is to be reimbursed for the cost of the asset. It is true that a machine which has been installed and used for a few weeks is already second-hand and could be sold for perhaps not more than half its cost, although it may still have a service life of 10 years. But the machine is not being held for sale; it is being held for use; and if only 3 months have expired of its total service life of 10 years, then only one-fortieth of its value to its owners has expired, and thirty-nine-fortieths of its value to them remain. The fact that its sale value might be less has nothing to do with the case. In other words, depreciation measures the exhaustion of service capacity in the assets; it does not measure the fluctuations in market prices of those or similar assets. It is well understood that, if any question of the sale of the properties should arise, their current market value would become very important; but information on that subject would naturally be sought for outside the books of account.

Depreciation and Public Utilities

A good deal of the literature relating to the subject of depreciation has originated with the public utility companies and their relations with regulatory commissions, especially on the subject of the rates which the utility companies may be permitted to charge their customers. It has become generally established that a public utility may make a charge high enough to cover its operating expenses and to yield a fair profit upon the value of the property invested in itself. The value of its property thus becomes an important question, in which the nature and extent of depreciation are very material facts. Arguments used in the course of such disputes do not necessarily have any direct bearing upon the ordinary industrial concern; but it may be pointed out that the utility companies themselves commonly include a straight-line depreciation charge in stating their operating expenses, except in those cases where they have resorted to the retirement accounting basis.

In determining the rate which will give a public utility an adequate gross income, the following questions, among others, are constantly arising: (1) How much depreciation charge should be included in the periodic expenses which must be covered by the rate? (2) In ascertaining the value of the investment on which the utility company is to earn a fair return, what account shall be taken of the depreciated condition of its plant—shall any deduction be made for that fact? (3) Is the sum total of charges made for depreciation against gross income during all periods of operation to be accepted as the measure of depreciation of the plant, in finding its fair value for rate making, as it is accepted for purposes of the balance sheet? Briefly it may be answered, in reply to these questions, that it is generally agreed that (1) an adequate amount, determined as in the case of any ordinary business, should be included among the operating expenses to cover depreciation; (2) there should be some deduction from the value for the depreciated condition; (3) but, for reasons largely legal, the amount of this deduction cannot always be measured as the sum total of the charges to expense on account of depreciation. The depreciation for this purpose is in practice usually ascertained by an engineering survey of the condition of the plant at the time.

Depreciation on a Composite Plant

Another matter which has led to some misunderstanding of the accounting provision for depreciation is the fact that the average plant consists of many and varied items of machinery and equipment, having various lengths of life. Moreover, as each item wears out it is either repaired or replaced, and in this way the entire plant is always kept up to that point of operating efficiency which the management desires. The history of the plant as a whole is, therefore, in contrast with that of a single unit of plant. For the latter it is a relatively simple matter to divide its estimated life into its original cost and arrive at an annual rate of depreciation which will write the asset off the books by the time it is to be discarded. But the plant as a whole will, of course, not be discarded but will be maintained in good operating condition. In the records of the plant as a whole, therefore, there is no steady progress from original cost to scrap value and no complete writing off. In the records, as in the plant itself, the progress or accumulation of depreciation is arrested by maintenance; those expenditures for repairs, renewals, and replacements which are expected to lengthen the life of a machine beyond the original estimate are debited to the reserve for depreciation, and a few years after the plant was new these expenditures are likely, in any average year, to amount to as much as the annual addition to the credit side of the reserve for depreciation. In this way the net value of the plant on books will remain about stationary, unless actual additions are made to it. It still remains true, however, that the plant as a whole is depreciated; a portion of its service value has expired, and the time of its replacement is nearer than for a similar plant that was altogether new. Individual items will continue to wear out, but the plant as a whole will continue to be kept by maintenance at about its present level of efficiency, and for the same reason its value in books will also remain very little changed.

QUESTIONS AND PROBLEMS

1. Explain the probable meaning of each item in the following account for Reserve for Depreciation:

RESERVE FOR DEPRECIATION

1928			1928		
Feb. 13	Accounts Payable..	$ 785	Jan. 31	Depreciation......	$1,650
Mar. 18	Accounts Payable..	1,940	Feb. 29	Depreciation......	1,650
April 11	Accounts Payable..	590	Mar. 31	Depreciation......	1,650
April 15	Plant and Machinery.......	700	April 30	Depreciation......	1,650
June 5	Accounts Payable..	1,353	May 31	Depreciation.......	1,695
			June 30	Depreciation.......	1,695

2. A piece of equipment is installed in the works of an electrical manufacturing company at a total cost of $4,500. Competent engineers state that, with ordinary careful maintenance, it will function well for 20 years; the experience of the company with that general type of machine is, however, that new and improved models are constantly being designed, which cause the old models to be discarded after between 8 and 12 years of active service. What would you consider to be a fair annual depreciation provision, and why?

3. The Wilcox Company keeps departmental accounts for equipment, for reserves for depreciation, and for expenses. On January 1, 19— the balance of the account, Plant and Machinery, Department B, was $275,400; Reserve for Depreciation, Department B, showed a balance of $55,200.

In these two accounts, and also in Depreciation and in Repairs and Maintenance, show the history of the plant for the succeeding half year, based on the following facts:

It is the company's practice to write off depreciation for this department at the rate of 10 per cent per annum, entries being made monthly and computed on the balance of the plant account at the end of each month.

January 20. A machine was removed from Department B and sold for the sum of $240. Its original cost was $3,600, and the depreciation already provided on it amounted to $3,400.

Repairs for January, $1,600; for February, $1,000.

March 6. A machine was entirely rebuilt, with many new parts, at a cost of $1,800; it was believed that its useful life would be greatly increased.

Ordinary repairs for March, $700.

April 14. A new machine was installed at a total cost of $4,200.

April repairs, $1,400.

May 8. A machine was moved from one site to another in the shop; a new foundation was necessary. The total cost of the removal was $600. The old foundation was useless.

May 17. A machine which cost $6,000 new was abandoned. Depreciation on this machine to date was $4,000. It was sold second-hand for $400.

May repairs, $1,300; June repairs, $1,700.

4. Explain fully the origin, meaning, and effects of the item, Reserves for Depreciation, in the balance sheet which follows.

Assets

Current Assets		
Cash	$ 45,800	
Notes Receivable	22,000	
Accounts Receivable	79,300	
Inventories	68,700	
		$215,800
Fixed Assets		
Plant and Machinery	$174,600	
Automobiles and Trucks	23,500	
Furniture and Fixtures	14,900	
	$213,000	
Less: Reserves for Depreciation	41,400	171,600
		$387,400

Liabilities and Capital

Current Liabilities		
Notes Payable	$ 37,800	
Accounts Payable	34,700	$ 72,500
Capital and Surplus		
Common Stock	$180,000	
Preferred Stock	100,000	
Surplus	34,900	314,900
		$387,400

5. A manufacturing plant, operating to the date of negotiations relative to disposition, was acquired by a newly formed corporation, the price therefor being based on present sound values which were stated to be as follows:

	Present Sound Value	Age
Machinery	$116,500	4½ years
	26,300	4 "
	217,300	2½ "
	16,750	2 "
	57,550	1 year
Equipment	$ 13,300	6 years
	11,650	" "
	27,660	1 year
Buildings—A	$285,700	12 years
A	15,000	5½ "
B	525,000	5 "
A	16,600	1 year

The estimated life of the machinery is ten years from date of original purchase; of equipment, fifteen years from date of purchase; of buildings A, thirty years and of buildings B, forty-five years.

It is desired to set up the assets on the books at present reproductive values, with a corresponding depreciation reserve to bring their net book value to the "sound values" given above. Compute the "reproductive value," the depreciation reserve, and give the future annual depreciation provision, all on the basis of a uniform rate each year until the book value is extinguished.

It may be assumed for the purpose of your answer that there will be no salvage value.[1]

6. A large manufacturing concern operates the following producing departments:[2]

a. Quarry, where mineral is extracted.
b. Railroad, 20 miles in length, from quarry to main plant.
c. Main plant, divided into
  Foundry and rolling mill.
  Process plant, where mineral is treated.
  Machinery department, where foundry product is finished, and
  Assembling department, where treated mineral and metal parts are combined into finished product.

Material	Quantity	Weight (Lb.)	Price (new)	Depreciated Value	Cost to Repair or Recondition	Scrap Value
Belting from lathe	20 ft.		$ 12	$ 3	$ 2.50	$ None
Pulleys from lathe shafting	5	150	60	20	10.00	1.50
Rock drills	20	200	20		5.00	2.25
Defective castings made in foundry	7	700	70		80.00	7.00
R. R. Ties	500		500		impossible	50.00
Lead-covered power transmission cable—quarry	300 ft.	1,200	240	48	impossible	144.00
Brass borings		500				50.00
Electric motors—machinery department	3		450	45	120.00	60.00
Large bolts—quarry	150	120	30		5.00	1.20
Copper boiler-tube from locomotives		50	15		impossible	6.50
Grinding rolls—process department	10	1,000	200	20	120.00	10.00
Gears for grinding rolls—made in own foundry	20	400	100	10	115.00	4.00
Steel tanks—process department	5	10,000	500	100	425.00	100.00
Plates and angle-iron from assembling department building		8,000	320		impossible	80.00

General expense of salvage department........ $ 1,000 per month
Turnover in money—about........ 100,000 per month

A salvage department is operating at the main plant, the function of which is to dispose of all discarded material either as scrap or—if possible to repair or recondition profitably—as material to be reissued for operation or construction.

From the above data, determine

---

[1] American Institute of Accountants, November, 1926.

[2] *Ibid.*, November, 1925.

a. The amounts to be credited the department from which the material is taken and whether credit is to operation or to a fixed-asset account.

b. The prices at which to be taken into salvage stock, and

c. Discuss generally and briefly the principles governing price at which salvaged material should be charged out and how savings due to salvage operations should be shown.

7. The plant and equipment and reserve for depreciation accounts, as presented below, represent the transactions for the year 1925, as recorded by the bookkeeper, employed by the A Company, January 1 of that year.

PLANT AND EQUIPMENT

1925			192		
Jan. 1	Balance	$500,000	Jan. 31	Screw cutting lathe	$ 150
17	Planer	2,000	Apr. 17	Steam engine	300
Mar. 21	Bolt machine	1,250	Sept. 30	Steel and lumber	400
Apr. 16	Crane	3,000	Dec. 31	Balance	524,650
3	Electrical equipment for crane	1,200			
27	Roof of machine shop	3,500			
June 3	Lathe belting	750			
Aug. 20	Wm. Smith, contractor	10,000			
Dec. 31	Machine shop	3,800			
		$525,500			$525,500

RESERVE FOR DEPRECIATION—PLANT AND EQUIPMENT

1925			1925		
Dec. 31	Balance	$175,000	Jan. 1	Balance	$125,000
			Dec. 31	Depreciation at 10% per annum	50,000
		$175,000			$175,000

Following is a description of the transactions, and you are required to make any entries you deem necessary to correct the accounts, giving reasons therefor, and setting up corrected accounts.

The balances at the beginning are assumed to be correct.

Planer, $2,000, is a standard machine purchased new.

Bolt machine was made in company's own shop. The $1,250 represents cost of castings, $500, and direct labor, $750. The machine-shop payroll was $20,000 ($15,000 direct and $5,000 indirect) during the year; castings and parts purchased were $17,000; general supplies were $4,000; rent was $2,500; light, heat and power were $3,500.

Crane and equipment, $4,200, are standard machinery, purchased new.

Roof of machine shop was destroyed by weight of snow during the winter. The new roof will be valueless when the building is obsolete.

Belting for all equipment amounting to $25,000 was charged to plant and equipment upon opening the plant and has not been depreciated.

William Smith is engaged in erecting an addition to the plant buildings. $10,000 is a first payment on uncompleted work.

Machine shop, $3,800, represents cost of making tools, setting machines and installing new machinery as follows:

Tool making	$1,000
Setting machines for special work	1,800
Installing planer	300
Installing bolt machine	200
Installing crane	500
	$3,800

Screw-cutting lathe—cost, 1918, $2,000.

Steam engine—cost, 1915, $15,000.

Steel and lumber, $400, represents salvage from machine-shop roof.

Prior to December 31, 1924, a separate account was kept for land and buildings.

Ten per cent per annum depreciation has been written off on plant and equipment.[1]

8. What is the difference between obsolescence and depreciation? Is there any difference in accounting for them?

9. What interest do the following parties have in the method of depreciation used by a company: management, directors, stockholders, mortgage bondholders, bankers, trade creditors, and the government?

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[1] American Institute of Accountants, May, 1926.

XIII

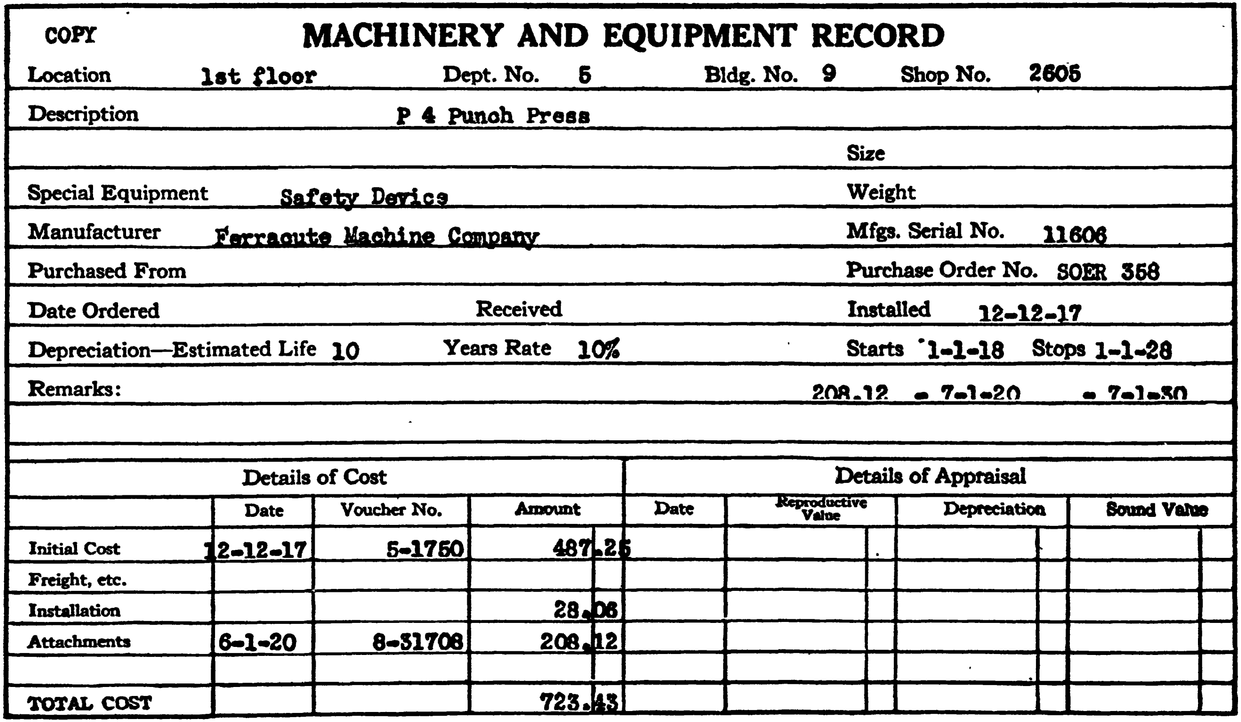
PLANT AND MAINTENANCE RECORDS

Detailed Plant Ledgers

A plant ledger is a book, card index, or loose-leaf record giving full particulars of a manufacturing plant, item by item; one or more sheets are devoted to each machine or piece of equipment, and give a complete life history of it. It is now quite a common practice for manufacturing concerns to keep a plant ledger; in this they have two objects in view. The first is to keep a record of individual items of plant, and the second is to accumulate a total depreciation charge which agrees with the sum of the depreciation charges on these individual items. In the absence of such a record it is necessary to estimate a blanket charge upon the whole plant; with very varied assets, with different useful lives, it is difficult to get a reliable charge by this blanket method. Some firms have very elaborate plant records, comprising a large number of cards, on which the depreciation for each item is recorded monthly. Other firms consider that this is an unnecessary amount of work; by the aid of the plant ledger they compute an annual depreciation charge, one-twelfth of which is the monthly charge for the total plant; but they do not go to the trouble of recording this monthly charge on the card for each individual item. In this way a good deal of clerical work is avoided. A typical card for a plant ledger is illustrated in Form 36, on page 214; it is safe to say that most of the larger and better managed concerns keep such a record.

Form and Content of Plant Ledgers

Form 36, after giving at the top of the card full particulars about the item of equipment, is divided in the lower half into two main parts, namely, details of cost, and details of appraisal. Only the former half is actually filled in for this illustration, but the presence of the columns for appraisal, together with the fact that the columns for Depreciation and Sound Value are



COPY

MACHINERY AND EQUIPMENT RECORD

Location 1st floor Dept. No. 5 Bldg. No. 9 Shop No. 2605

Description P 4 Punch Press

Size

Special Equipment Safety Device Weight

Manufacturer Ferracute Machine Company Mfgs. Serial No. 11606

Purchased From Purchase Order No. SOER 358

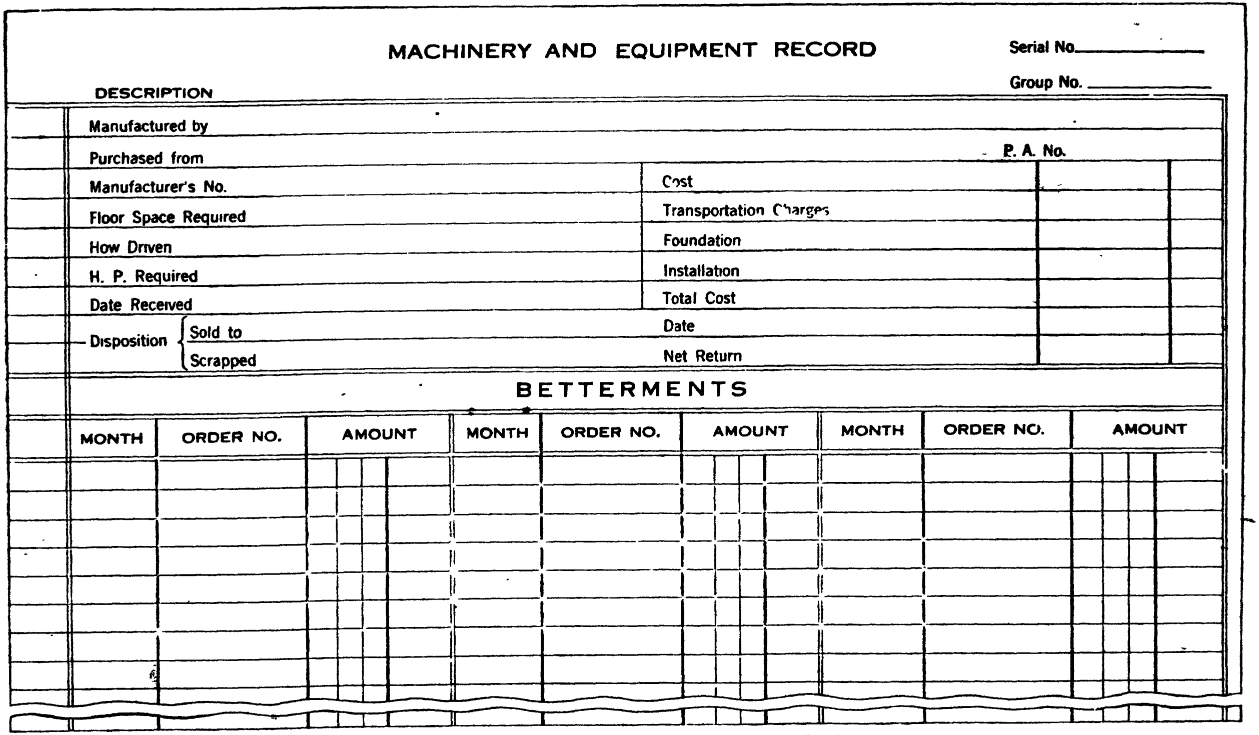
Date Ordered Received Installed 12-12-17

Depreciation—Estimated Life 10 Years Rate 10% Starts 1-1-18 Stops 1-1-28

Remarks: 208.12 - 7-1-20 - 7-1-30

	Details of Cost			Details of Appraisal			
	Date	Voucher No.	Amount	Date	Reproductive Value	Depreciation	Sound Value
Initial Cost	12-12-17	5-1750	487.25				
Freight, etc.							
Installation			28.06				
Attachments	6-1-20	8-31708	208.12				
TOTAL COST			723.43				

Form 36: A card for a plant ledger.



MACHINERY AND EQUIPMENT RECORD

Serial No.__________

Group No.__________

DESCRIPTION

Manufactured by

Purchased from P. A. No.

Manufacturer's No.	Cost		
Floor Space Required	Transportation Charges		
How Driven	Foundation		
H. P. Required	Installation		
Date Received	Total Cost		
Disposition { Sold to	Date		
Disposition { Scrapped	Net Return		

BETTERMENTS

MONTH	ORDER NO.	AMOUNT	MONTH	ORDER NO.	AMOUNT	MONTH	ORDER NO.	AMOUNT

Form 37*a*: Machinery and equipment record—front.

Serial No ______________

Group No. ______________

Dept.	Jan 1st. 1923								Dept	Jan 1st, 1930								
Depreciation	%								Depreciation	%								
Depreciated Value									Depreciated Value									
Betterments									Betterments									
Dept	Jan. 1st, 1924								Dept	Jan. 1st, 1931								
Depreciation	%								Depreciation	%								
Depreciated Value									Depreciated Value									
Betterments									Betterments									
Dept.	Jan. 1st, 1925								Dept.	Jan 1st, 1932								
Depreciation	%								Depreciation	%								
Depreciated Value									Depreciated Value									
Betterments									Betterments									
Dept	Jan 1st. 1926								Dept.	Jan. 1st. 1933								
Depreciation	%								Depreciation	%								
Depreciated Value									Depreciated Value									
Betterments									Betterments									
Dept.	Jan. 1st, 1927								Dept	Jan 1st, 1934								
Depreciation	%								Depreciation	%								
Depreciated Value									Depreciated Value									

Form 37*b*: Machinery and equipment record—back.

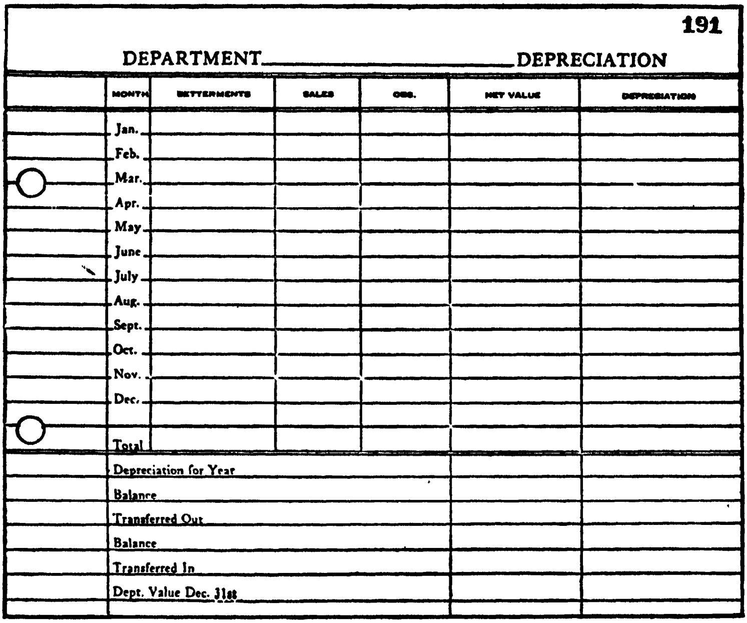
under this main head, indicates that this company has adopted the practice of depreciating upon the appraised-value basis. At least they used the appraised value for all items for which the original cost was not easily available. In some cases a company will have a complete appraisal made of its old plant and will use the appraised values for the depreciation of all items included in the appraisal; but all items added subsequently to the appraisal will be depreciated upon the basis of their original cost. In this same form Installation and Attachments are given as separate items; sometimes these, especially the cost of installation, are depreciated at different rates from that applied to the machine itself.

Form 37 shows a very different arrangement; here there is no reference to any appraisal, the original costs being recorded in the top right corner; the items Transportation Charges and Foundation are shown separately, though added in with the total cost. In this case betterments were an important factor, and ample space is provided for the record of expenditures upon this item of plant which are of such nature as to lengthen its life beyond the original estimate. On the back a serial record is provided showing, for each year, the value at the beginning of the year, the depreciation for the year, the remainder or net value, and the betterments for the year which, when added to the previous figure, give the balance carried forward to the new year. Thus each year's depreciation is figured on the combined total of the original cost plus all improvements to date. These forms reflect an attempt to handle the depreciation question, with the allied subject of maintenance, in as careful and scientific a manner as possible.

Summarizing the Individual Records

Form 38 is used by the same company as Form 37; but whereas the latter is the individual record by which the history of each machine is kept, Form 38 summarizes all the individual records for one department into departmental totals. The total betterments for each month are recorded, together with particulars of machines discarded or sold during the month, leaving a net value of the equipment in the department at the end of the month, upon which depreciation is figured. This monthly summary would furnish the depreciation and betterments figures for the monthly operating statement and cost records of the department. At the bottom of the form the monthly figures are combined into yearly totals.

A great variety of forms is used for plant ledgers, according to the requirements of the individual plant,[1] but Forms 36 and 37 are typical of those more commonly used.



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DEPARTMENT__________DEPRECIATION

	MONTH	BETTERMENTS	SALES	OBS.	NET VALUE	DEPRECIATION
	Jan.					
	Feb.					
	Mar.					
	Apr.					
	May					
	June					
	July					
	Aug.					
	Sept.					
	Oct.					
	Nov.					
	Dec.					
	Total					
	Depreciation for Year					
	Balance					
	Transferred Out					
	Balance					
	Transferred In					
	Dept. Value Dec. 31st					

Form 38: Yearly summary of depreciation records.

Uses of Plant Ledgers

The practical advantages of plant ledgers are indicated largely by the types of businesses which use them. The managers of small plants, with a limited number of pieces of equipment, usually consider that they can do all that they wish to in the way of using the plant to best advantage by personal observation of the equipment, and that they can make all necessary depreciation computations upon a simple schedule containing all plant items.

Among large plants, however, having numerous items of equipment, a detailed plant record will afford the means for a far more effective control of the plant assets than could be had from personal observation, and in these companies such records are quite generally found; it is safe to say that many medium-sized concerns can also with advantage use this type of record. Its advantages may be described principally under three main headings: (1) the accounting control of plant assets and of the related depreciation accounts, (2) the physical management of the plant, and (3) the facilities afforded for proving the summary depreciation accounts by means of detailed supporting schedules on such occasions as tax, legal, or other controversies involving questions as to the condition of the plant.

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[1] National Association of Cost Accountants, 1925 *Yearbook*, pp. 51–80.

Accounting Control of Plant and Depreciation

In the absence of plant records a company is left to the computation of depreciation by the application of blanket percentage rates to the general totals of plant asset accounts. Since these general totals will often include a wide variety of types of equipment, subject to varying degrees of physical and functional depreciation, it is impossible that such blanket computations can have any high degree of accuracy. In so far as correct totals are not available, the balance sheet showing the condition of the plant, and the operating statement of earnings, will be correspondingly in error. Nor can proper cost analyses with accurate depreciation charges to specific operations or departments be made without considerable computation of depreciation rates. A plant ledger properly organized will have the items classified not only by types of equipment but also by departments, as in Form 38; the summaries of the latter classification will afford the necessary data for departmental depreciation charges for use in the burden distribution.

Physical Control of Plant

The plant ledger, with its detailed records of repairs and maintenance done on individual plant assets, provides a reliable record of the behavior of those assets and the economy of their operation. When new machines or equipment are wanted, valuable guidance may be had from these records as to what are the most reliable and economical types of equipment. Those machines which are expensive to maintain or uncertain in operation will easily be noted from the record.

When machines of the same type and purpose are brought together in the summaries, the quantity of each class of equipment comes to attention; the fact that there are similar items of equipment in different parts of the plant or in different plants of the same company, and that altogether they are in excess of any possible requirement of the business as a whole is easily noted, whereas it would not be observed without the record. In this way a plant ledger has often helped in a rearrangement of the plant, unnecessary items of equipment being disposed of and the rest of the machines rearranged to better advantage. This is particularly useful when requisitions come in from some departments for equipment which may be on hand in other departments and there not used to capacity; many purchases of unnecessary equipment have been avoided in this way.

Still another occasion when detailed plant records serve the management in a practical way occurs when requests from department heads for additional equipment have already been granted upon representations as to the amount of savings which will thereby be effected, as compared with the amount of extra cost which will be involved. Some companies keep careful notation of such authorizations and use their plant ledger records to check up actual performance after the new equipment has been installed. The savings in expense, the extra output, the expense for maintenance and repairs, and all other pertinent matters are carefully recorded and the net results compared with the promises made by the department manager when he applied for the new equipment to be authorized. In a large plant this sort of check-up is indispensable if the company wishes to avoid being burdened with large investments in questionable extensions of the plant.

Establishing Depreciation and Repairs Expense in Tax Returns

One of the most urgent practical considerations for a modern business is to be able to substantiate the items which enter into its income tax return. Among these the amounts for depreciation and for maintenance and repairs come in for especially careful scrutiny and frequent challenge by the Internal Revenue Department; it is therefore essential for a company to be able to support the amounts stated under these headings whenever occasion may arise. This may occur not only for tax purposes but whenever, in the course of legal or other disputes, any question of manufacturing costs comes up. In an extensive plant such questions necessarily involve complicated and detailed computations involving the behavior of large numbers of varied items of equipment. Unless the detailed records are available by which such data may be supported, a company is at a great disadvantage in such controversies; a plant ledger may then pay for itself many times over by the information it provides in support of summary totals which otherwise could not be proved.

Maintenance and Betterments

It is obvious that any computation of depreciation must take into account the repairs and maintenance policy of the business concerned. Machinery that is carefully handled and well looked after will last longer than machinery which is not so well handled; on the other hand, if progress is rapid in that line of business, the danger of obsolescence will be increased with a longer physical life for the asset. Two different practices are found in this situation. Probably the more common practice is to charge current repairs and maintenance to a repairs account kept separate from all depreciation records. For depreciation purposes it is then assumed that ordinary maintenance attention will be given to the machines, and their useful life is estimated on that basis. From this estimated life the annual depreciation is calculated; in these circumstances it is clear that depreciation will be unaffected by current repairs, and the record for depreciation will go on steadily through the life of the asset. Under this method a fixed and equal charge is made each year for depreciation, but a fluctuating charge is made to the various years for repairs and maintenance, which sometimes will vary to a very substantial degree.

Standard Monthly Maintenance Charges

Some firms follow a method which seeks to avoid this fluctuating annual charge for repairs. They do so by considering not only the original cost of the asset but by estimating also the total cost of repairs which will be necessary through its life. By combining the first two figures the total cost of the machine, original and current, is obtained. If this total figure be divided bv the useful life of the asset, an annual charge will be obtained which includes both depreciation and maintenance, and this annual charge will be the same in each year. Under this method actual expenditures for repairs and maintenance are charged against the reserve for depreciation. Some of the best managed concerns follow this practice, but it is doubtful whether two such uncertain elements should be combined in this way; a better understanding and control of each can be secured by keeping them separate. To do this a separate reserve for maintenance can be set up, against which all repairs are charged as they occur. The monthly or annual charge in the income statement is then the amount of the addition or credit to the reserve account.

Under either method, substantial renovations of assets will be made from time to time, of such thoroughgoing character as to prolong the life of the asset beyond the original estimate. In both cases such expenditures are to be charged to the reserve for depreciation, enhancing the net book value to correspond with the increased life; but whereas under the latter method *all* expenditures for repairs and maintenance, big and little, are charged to the reserve for depreciation, the former method requires that the large expenditures for betterments, which are charged to the reserve for depreciation, are to be distinguished from the expenditures for current repairs and maintenance, which are not included in the provision for depreciation and are therefore to be charged to an expense account, Repairs and Maintenance. It is not always easy to make this distinction, but every company will adopt a few practical rules for its own guidance in the matter.

Accounting for Maintenance Work

In any large plant the expenditures for repairs and maintenance are likely to involve considerable sums, and it is necessary to establish a procedure which will provide both an accounting and a control of the money spent.

It will usually be found convenient to divide all maintenance work into three classes, the first consisting of the regular routine work of inspecting, oiling, and adjusting the various pieces of equipment, all done in accordance with a schedule prepared by the plant engineers. The second class consists of the numerous but minor daily repairs and adjustments, which are individually small but may amount to considerable sums in the aggregate; and the third includes the larger jobs. For the first and second groups no special authorization may be necessary; the repair men will deal with such matters at once when called upon, or according to schedule. In the records they will be charged to certain standing orders, designed to accumulate the totals of such expenses and to avoid the necessity for separate records of small amounts. For the third group something more is needed; it may be specified that no repair job over a certain amount shall be commenced without the authority of the superintendent or manager, and in order to obtain his consent an application which includes an estimate of the costs will have to be filed. If the application is granted, one purpose of the accounting will then be to see how the actual costs compare with the estimates; a cost sheet is therefore prepared and completed in the same way as under any job or order method of costing. In one company a foreman could have repair jobs costing less than $5 each done on his own request, these being called "foreman's expense orders." Jobs costing over $5 required the superintendent's confirmation, and these were put through on "shop expense orders."

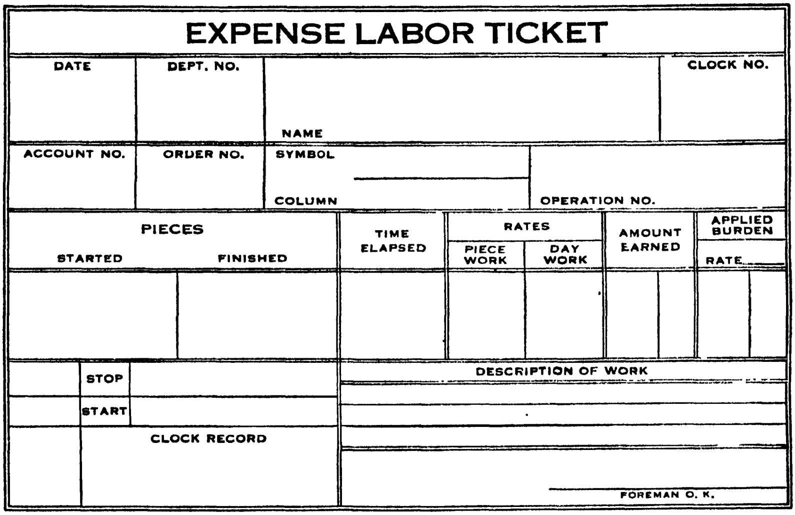
Then comes the important matter of the accounting disposition of the costs; these will normally be divided into three main classes, namely, (1) those chargeable as current expenses to repairs and maintenance; (2) those chargeable as betterments to the reserve for depreciation; and (3) those which are new construction, additions to the plant, to be charged therefore to the plant account. Sometimes there is a fourth class of charge, namely, machine parts made and put into stores inventory; and occasionally work may be done in the repair shop for customers and charged therefore to cost of goods sold.

Replacements

When complete assets are replaced, it is desirable to make separate records of the retirement of the old assets, and the acquisition of the new; this is the method prescribed for railroad accounting by the Interstate Commerce Commission. When an asset is discarded, its original cost is credited in the plant account, the amount of reserve accrued on it is debited to the reserve for depreciation, and any difference is debited to an account such as Loss on Plant Retirements. The old asset is then completely removed from the books, and the new asset may, when purchased, be debited to the plant account. But such a method presupposes that detailed records are available to show the cost and the amount of reserve for each item of plant. Often this information is not to be had, and then the figures for the old asset may be estimated and used for removing it from the books.

Separate Labor Tickets

In many companies one feature of the gathering of maintenance costs is the use of a labor time ticket different from that used on products made for sale. Such a ticket is shown in Form 39; the information it contains is like that for direct labor, but it is a different color and charged to a burden account.



EXPENSE LABOR TICKET

DATE	DEPT. NO.	NAME	CLOCK NO.
ACCOUNT NO.	ORDER NO.	SYMBOL COLUMN	OPERATION NO.

PIECES		TIME ELAPSED	RATES		AMOUNT EARNED	APPLIED BURDEN
STARTED	FINISHED		PIECE WORK	DAY WORK		RATE

STOP

START

CLOCK RECORD

DESCRIPTION OF WORK

FOREMAN O. K.

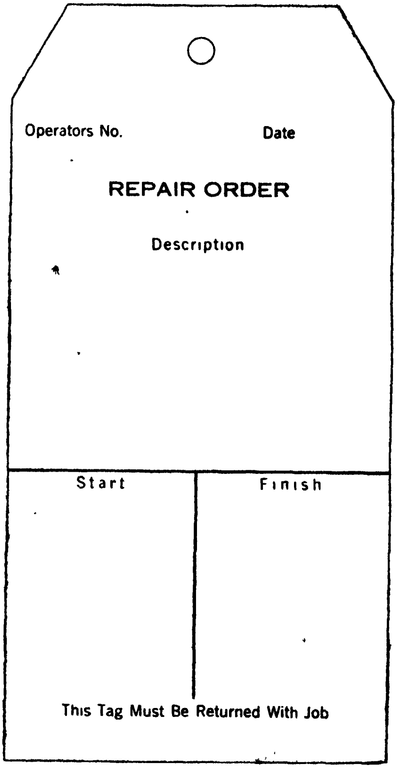
Form 39: A labor ticket for overhead labor.

Typical Order Forms Illustrated

The procedure here described will be better understood by looking at some of the other forms commonly used for maintenance records. Here, as in all forms, there is a great variety among different businesses in the amount and nature of the detail they give, but the essential features are the same in all. The forms shown on the following pages were used by a large company making in vast quantities an article of daily household use; the company did practically all its own repair and maintenance work, except the making and machining of heavy castings, which were done outside. The machine shop employed a corps of about 145 machinists, toolmakers, millwrights, carpenters, painters, tinsmiths, and general repair men.

Small Repair Orders

For small repair orders, estimated to cost not over $25 each, a simple tag (Form 40) was used. This form described the work to be done and provided spaces for the number of the operator who did the work and the time he spent on it. In the description would be included the department to be charged. If any materials were used, a material requisition was made out for them; this requisition, after being executed by delivery of the materials from the stores, was attached to the repair order tag. Since the total repair order could not exceed $25, the value of materials used naturally could not be very great. When all the work was completed, the repair order was sent to the cost department to be figured for cost purposes.



Operators No. Date

REPAIR ORDER

Description

Start	Finish

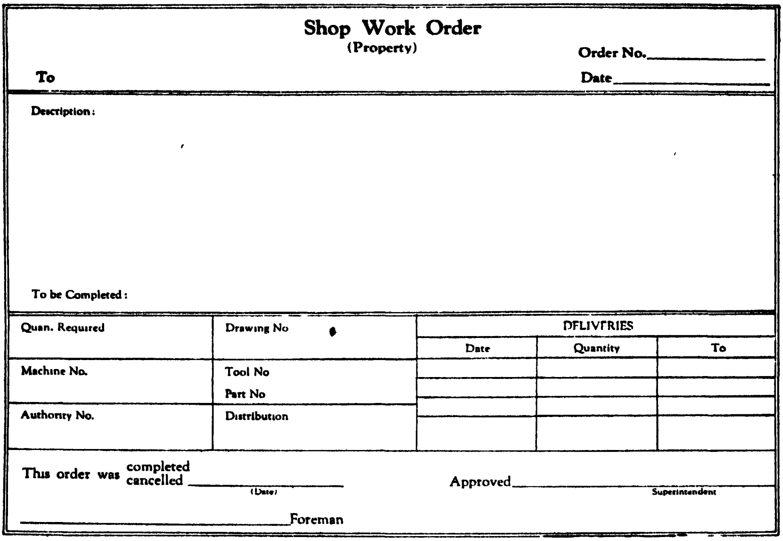
This Tag Must Be Returned With Job

Form 40: Repair order for small amounts.

Larger Work Orders

In this particular company orders for larger amounts than $25 were known as "shop work orders," and one of these is illustrated in Form 41. It will be seen that this form is a relatively simple matter; but it might be used as an order for quite elaborate equipment, running into a great deal of money. In such cases only a brief general statement was made in the

Description space; a Drawing Number was filled in, and these drawings, together with any other papers or information needed, were attached to the shop work order. The order illustrated is marked (Property), indicating that it was for some piece of equipment which was to be added to the Plant account. Forms of the same printing, but with different colors, were used for Stock, Maintenance, and Special Distribution, according as the costs were to be charged to one or another of these accounts.



Shop Work Order
(Property)
Order No.________
To
Date________

Description:

To be Completed:

Quan. Required	Drawing No	DELIVERIES		
		Date	Quantity	To
Machine No.	Tool No Part No			
Authority No.	Distribution			

This order was completed / cancelled ________ (Date)
Approved________ Superintendent
________Foreman

Form 41: Shop work order – for larger amounts.

This form was the actual order and authority for the work to be done and so was made out only with the permission of the plant official who had power to authorize such work.

Cost Records—Small Repair Orders

At the end of the month all repair orders (Form 40) were summarized in the cost department in columnar form as shown on page 227.

Before being entered in the summary, the repair orders were sorted according to the department to which they were to be charged, so that all the orders chargeable to a department could be entered together. From the time given on the repair order the labor charge had already been computed for payroll purposes and noted on the order; this amount was entered in the

Labor column of the summary. The amounts of any material requisitions attached to the repair orders were entered in the Materials column, and the total extended into the last column.

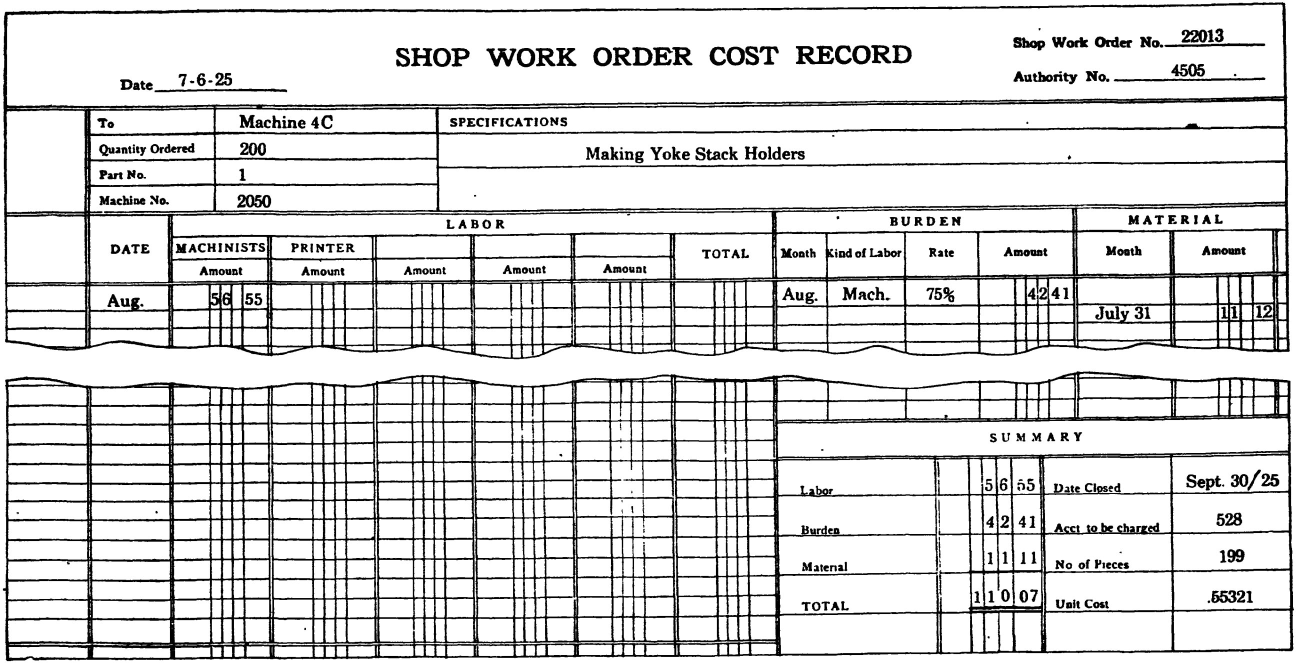
. . . . . .19. . SUMMARY OF REPAIR ORDERS—DEPARTMENT M

Order number	Materials	Labor	Total
964	$ 3.74	$ 10.30	$ 14.04
969	. . . .	5.60	5.60
983	11.90	4.55	16.45
Etc.			
Totals.	$167.33	$249.65	$416.98
Burden 75% of labor.		187.23	187.23
Debit Department M.			$604.21

When all the repair orders for any one department had been entered on the summary sheet, the Labor, Materials, and Total columns were added. Then to the total was added a sum of 75 per cent of the labor total, this being the overhead rate of the machine shop itself. It covered the foreman, clerks, and other indirect workers and the fixed charges of the machine shop. It was not considered worth while to add this figure to each separate repair order; but by calculating it for the entire list of orders for each department, the total charge for that department was found, and this is all that was really necessary in order to find a complete and accurate charge to the department for which the work was done.

Shop Work Order Cost Record

But when a shop work order was issued, as described above, it was costed according to the methods of job order costing (see page 228) on a sheet as illustrated in Form 42. The procedure with this form was just the same as if the order were for some product being made for sale. The cost record contained columns for labor, burden, and materials charges; all workmen's job tickets marked with this order number and all material requisitions so marked were entered and totaled in the proper columns of this sheet. Then the burden rate of the maintenance department, namely, 75 per cent of the labor charges, was entered in the Burden column, and all the costs were summarized at the bottom. The total cost of the entire



SHOP WORK ORDER COST RECORD

Date 7-6-25

Shop Work Order No. 22013

Authority No. 4505

To	Machine 4C	SPECIFICATIONS
Quantity Ordered	200	Making Yoke Stack Holders
Part No.	1	
Machine No.	2050	

DATE	LABOR						BURDEN				MATERIAL	
	MACHINISTS	PRINTER				TOTAL	Month	Kind of Labor	Rate	Amount	Month	Amount
	Amount	Amount	Amount	Amount	Amount							
Aug.	56 55						Aug.	Mach.	75%	42 41		
											July 31	11 12

SUMMARY

Labor	56 55	Date Closed	Sept. 30/25
Burden	42 41	Acct to be charged	528
Material	11 11	No of Pieces	199
TOTAL	110 07	Unit Cost	.55321

Form 42: Shop work order cost record.

order was charged to the account number indicated in the space Account to be Charged.

Maintenance Department Control

These repair orders and shop work orders were the detailed records of individual jobs or pieces of work being done by the maintenance department. In a plant of any size there would in an active period be hundreds of these going on at the same time; it would be too much trouble to get the figures for the financial statements directly from these, and the management would wish to keep a control over the total of such work going on. To do this, a control account called Maintenance Department, Work in Process, was kept in the cost ledger, an example of which is shown below:

MAINTENANCE DEPARTMENT – WORK IN PROCESS

1933					1933				
Feb.	1	Balance		9380 00	Feb.	28	Repairs & Maint'ce		90100 00
	28	Materials Used		46250 00		28	Replacements		12500 00
	28	Labor		55250 00		28	New Plant		24400 00
	28	Burden		35000 00		28	Parts Manufactured		10200 00
						28	Balance-Inv.		8680 00
				145880 00					145880 00
Mar.	1	Balance		8680 00					

Form 43: Control account for work of maintenance department.

The items in this account are found in the same way as similar items in a Work in Process account of goods being manufactured for sale. The balances are the inventories of work in hand at the beginning and end of the month; the amount in each case is the total of all the repair and shop work orders in process on the date given. Materials Used is the total of all requisitions for mechanical parts and other materials needed for the work of this department. Labor is the total for the month of the weekly payrolls of this department, for direct labor only, for work done on repairs, maintenance, and new construction. Burden is the sum total of all fixed charges and other indirect expenses of the maintenance department; this figure is found as the total of a Maintenance column in the burden distribution sheet for the entire plant. These expenses have, in this plant, four different kinds of results and are therefore charged to four different accounts, namely,

1. The expenses of purely repair and maintenance work are charged to Repairs and Maintenance account and appear as such in the income account.

2. Replacements in this case is the name given to those expenditures for the renewal of major parts of machines, or even of whole machines. Since these machines have been depreciated in the Reserve for Depreciation account, and since these renewals remove such depreciation, the total of this class of work is charged against the Reserve for Depreciation, thus reducing it and increasing the net value of the plant in the books.

3. New Plant is the total value of work done by the maintenance department in the construction of new machines or equipment to be added to plant; this amount is therefore debited to Plant and Machinery account.

4. When machine parts are used frequently and in considerable numbers, it is usual to make a considerable stock of them at one time, at least enough to make an economical run. These parts are then put into the stores of the maintenance department for use as needed. An inventory account, called Maintenance Stores, or Mechanical Stores, to distinguish it from the regular stores of raw materials, is kept in the ledger, and this account is charged for the $10,200 now being credited to the maintenance department for parts manufactured. When the parts are taken out and used on jobs, they will be charged as Materials Used in the Maintenance Department account.

Balancing the Maintenance Department Account

It may well be asked, how the Maintenance Department account (Form 43) is balanced every month in the sense of absorbing all the burden charges of the department. Putting the question in other words, if the burden of the maintenance department is charged to jobs at a fixed or standard rate, like the 75 per cent mentioned in the preceding pages, there will be a discrepancy of unabsorbed or overabsorbed burden, as in any ordinary Work in Process account, and the Maintenance Department account would not balance. To avoid this situation some companies do not use a standard or fixed burden rate but figure a new actual burden rate for the maintenance department each month. For example, in Form 43 the burden of $35,000 is 63.4 per cent of the labor; if then this rate of 63.4 per cent be applied to the labor charges in all jobs summarized on the credit side of the account, the burden of $35,000 will be exactly absorbed and there will be no balance.

Disadvantages of Actual Burden Rate

This method has the disadvantages of any actual burden rate, as discussed on page 177; but that discussion related to goods being manufactured for sale, whereas the work of the maintenance department is to be charged either to an expense account or to an asset account. The problem of determining a selling price does not therefore arise, and some people consider it permissible to use the actual burden rate for the maintenance department in spite of irregularities of the charges thus developed. On the other hand, it must be recognized that the cost of a new piece of equipment might be varied considerably by constructing it in a period when the maintenance department was inactive and therefore had a high burden rate, as compared with constructing it in an active period with a low burden rate. Differences as wide in proportion as those indicated on page 177 might easily arise.

Other Plans for Maintenance Burden Allocation

For this reason some companies do not add burden to the individual job costs of their maintenance department; they charge the jobs only with the direct materials and direct labor put into them. The burden costs of the maintenance department are then combined with the general burden of the plant and allocated along with it to the direct productive departments. They claim for this method the following advantages:

1. Saving clerical work in costing for the maintenance department.
2. A more effective control over the burden of the maintenance department by budgeting it as a separate and distinct division.
3. Conservative valuations on work charged to asset accounts.

Still another method used in some cases is to gather all overhead of the maintenance department in one account. Each maintenance and construction job is charged with its direct materials and labor costs. At the end of each month the maintenance overhead is allocated to (1) maintenance expense, (2) plant assets, and (3) cost of outside sales, in proportion to the dollar charges already made to these divisions for the direct costs of the maintenance department, as shown in the job costs.

Policy on Maintenance Department

When it comes to the matter of controlling or budgeting the costs of the maintenance department, it is necessary to visualize a program for that department, and certain important questions of policy arise. These questions are particularly urgent during a depression period, when reduction of expenses all through the plant is one of the major objectives. What then should be the attitude toward the maintenance department? A few observations will be offered on the different ways in which a number of companies have tackled this problem. Clearly we are not concerned here with methods of accounting for the maintenance work, but with the problem of budgeting it and of determining what policies shall be adopted as a basis for budgeting.

In the first place an exact and automatic budgeting of the maintenance department is probably out of the question; unexpected developments are constantly arising from accidents or breakdowns or from the necessities of adopting new inventions or new products. In most well-organized businesses this does not lead to an abandonment of budgeting attempts but rather to a flexible view of the budget, permitting adaptations and modifications as need arises.

One company, for example, has constructed budgets for its maintenance department based on 100, 80, 60, and 40 per cent operation of the entire plant; the effort was made to figure a personnel for the maintenance department suitable for each of these degrees of operation. This proved to be a helpful starting point; but whenever it became necessary to modify the budget, no hesitation to do so occurred.

Outside Purchases of Maintenance and Construction Work

One of the first questions which the plant officials must answer is how far they intend the plant to be self-sufficient in regard to maintenance and construction work. In other words, how completely do they wish to have all this work done by their own maintenance department and how far do they expect to buy machinery and equipment outside or to call in outside crews on their maintenance work? In a fair-sized plant, to undertake all the work, including new additions to plant, requires not only a big crew of machinists, tool makers, carpenters, and so forth, but also a substantial monthly salary list for engineers, draftsmen, designers, and other experts and department heads. The fixed charges are thereby considerably increased and the burden during a period of inactivity is heavy. To charge all this overhead to a few jobs brings their cost up considerably, often making them in excess of outside quotations. To let these salaried people go, on the other hand, means that they may not be available when better business comes and the company might use their services to good advantage.

Deferred Maintenance

Another form of the question is how far it is wise to omit or defer maintenance during a period of business inactivity. In the depressions of the past some businesses have gained an advantage by keeping their plants in first-class condition and thereby being able to take advantage of improved business as soon as it appeared. Other companies, having let their plants run down, experienced delays in getting into good operating condition when orders were actually being offered to them. But the pressure of financial considerations is great and the wise course seems to be a happy medium between these two extremes.

Routine Attention to Plant

A considerable proportion of the regular work of the maintenance department consists of the routine inspection, oiling and adjustment of machinery. Regular schedules for all of this work are laid down by the plant engineers, including the periodic complete overhauling of machines. The primary object here is to secure 100 per cent efficiency in operation and to prevent breakdowns. Since this work is not of an emergency character, it can be distributed to the staff on a regular schedule and thus can be economically performed. But even on this work companies have by study been able to reduce their cost substantially. They have found, for example, that complete overhauling of certain types of machines could be done every four months instead of every 10 weeks, and the frequency of other operations similarly reduced. With a big maintenance department staff such studies have permitted considerable reductions without impairing the efficiency of the plant.

Repairs and Maintenance

After defects or breakdowns have appeared, still further options are presented during periods of low activity. When trade is good, many companies pride themselves on keeping their plant in first-class condition, whether they have immediate use for it or not. This ideal may prove to be impracticable during depression periods, and instead the policy may be adopted of not repairing machines if similar and alternative equipment is available. In this way the general condition of the plant is allowed to run down and only those units which are required immediately for operation are kept in good repair. Obviously this is a policy exposed to the dangers mentioned above, of being unable to take advantage of good business if it should be unexpectedly offered. It also represents deferred maintenance, in that some costs are thus postponed to future periods.

New Plant Construction

When it comes to the question of spending considerable sums of money on the plant, whether to replace old equipment, to add new equipment, or to make any substantial rearrangements, a period of depression will naturally cause a good deal of hesitation. It may be that the proposed new expenditures are needed to keep the company in the forefront of the competitive battle, and if so the management will wish to undertake them even if they involve some sacrifice and risk. For large expenditures of this sort an appropriation by the board of directors, or by a committee set up by the board, is likely to be required. The sort of evidence which is submitted to the Board to justify their consent will vary in different cases. Sometimes it is possible for the plant engineers to submit technical data which will be decisive in showing that the proposed new equipment would well pay for itself. Usually the advantages claimed can be expressed in terms either of reduced cost or of greater production for the same cost. In other cases the new equipment may be needed for an entirely new product, in which case the prospects for the new product will be the determining factor, and this is something which cannot be mathematically demonstrated in advance.

Economy programs brought about by depression have led to the requirements being increased as regards the advantages claimed for new equipment. Some companies, for example, in ordinary times will authorize expenditures for equipment if it is reasonably evident that the new equipment will pay for itself within from three to five years; but during business depression they have required fairly definite evidence that the new equipment would save its own cost in from one to three years.

Application for Appropriation

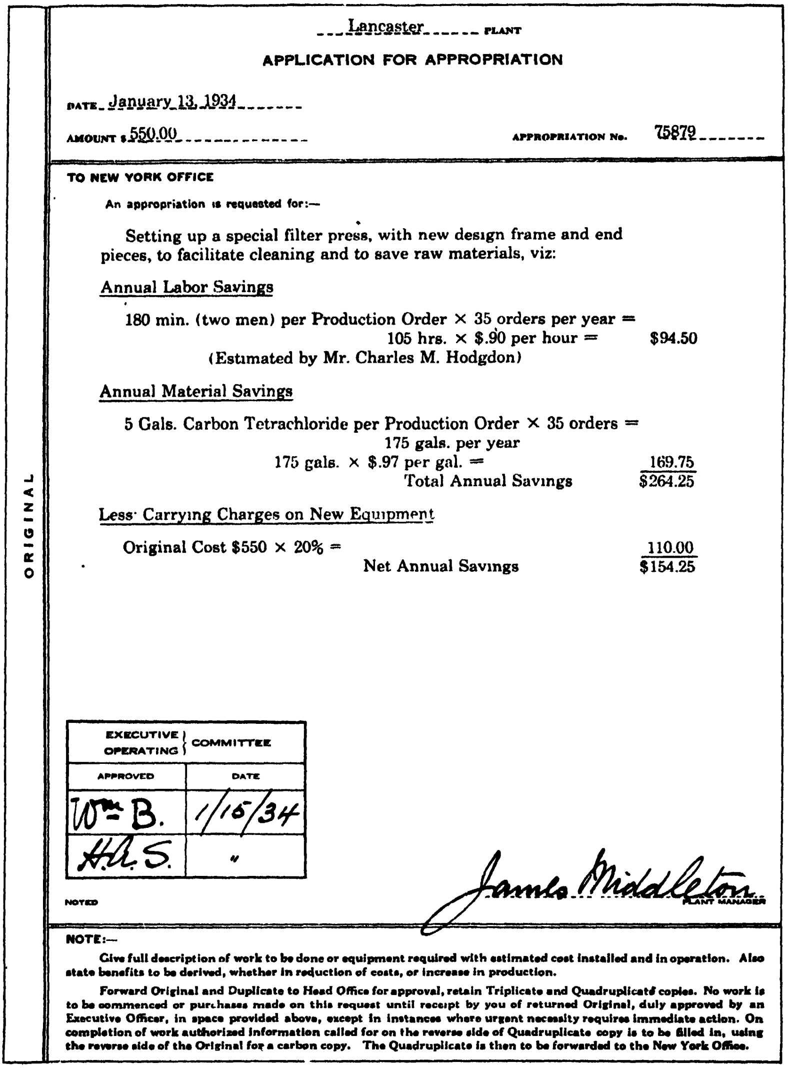
In order to illustrate this matter, Form 44 is given on page 236 showing an application made to a board of directors for a new piece of equipment. All proposed expenditures exceeding $500 had to be submitted to the board in this case.

Four copies of this application are prepared, and at the foot of the form instructions for handling the various copies are given. The advantages claimed for this particular application are of two kinds, namely, a saving in labor and a saving in materials reclaimed. From the estimated annual savings is deducted an amount representing the annual carrying charges of new equipment, figured at 20 per cent. This is made up of 10 per cent for depreciation, 6 per cent for interest charges, and 4 per cent for taxes and insurance. The net result is an estimated annual saving of $154.25; the question for the directors is whether they are willing to spend $550 in order to secure this annual saving.

Discussion on the Application

If the estimated savings are reliable, this piece of equipment would pay for itself in a little less than four years, which ordinarily would be regarded as justifying the expenditure. The directors wished, however, to make sure that the estimates were reasonable. They noted first that the savings were estimated by Charles M. Hodgdon, one of the plant engineers. Since he was known to them as an accurate and conservative investigator, they were disposed to place reliance on his estimates.

With regard to the labor saving it was pointed out that an occasional saving of 180 min. divided between two men, or an hour and a half each, was a rather precarious saving for men employed on day work in tending equipment of this sort. The total saving was 105 hr. in a year; this would not permit of reducing the force by one man, and it would be only by making



ORIGINAL

Lancaster PLANT

APPLICATION FOR APPROPRIATION

DATE January 13, 1934

AMOUNT $550.00

APPROPRIATION No. 75879

TO NEW YORK OFFICE

An appropriation is requested for:—

Setting up a special filter press, with new design frame and end pieces, to facilitate cleaning and to save raw materials, viz:

Annual Labor Savings

180 min. (two men) per Production Order × 35 orders per year =		
105 hrs. × $.90 per hour =		$94.50
(Estimated by Mr. Charles M. Hodgdon)		
Annual Material Savings		
5 Gals. Carbon Tetrachloride per Production Order × 35 orders =		
175 gals. per year		
175 gals. × $.97 per gal. =		169.75
Total Annual Savings		$264.25
Less· Carrying Charges on New Equipment		
Original Cost $550 × 20% =		110.00
Net Annual Savings		$154.25

EXECUTIVE / OPERATING COMMITTEE	
APPROVED	DATE
Wm B.	1/15/34
H.A.S.	″

NOTED

James Middleton
PLANT MANAGER

NOTE:—

Give full description of work to be done or equipment required with estimated cost installed and in operation. Also state benefits to be derived, whether in reduction of costs, or increase in production.

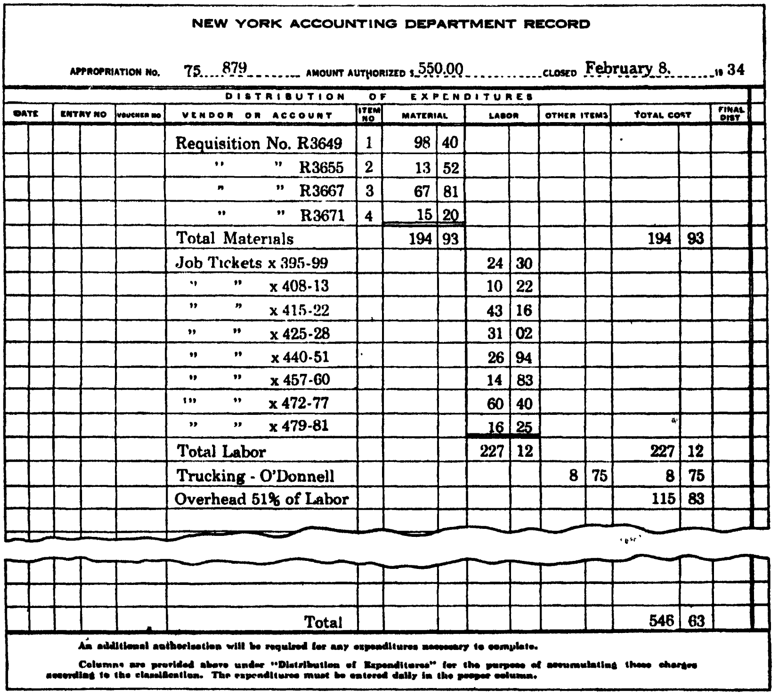
Forward Original and Duplicate to Head Office for approval, retain Triplicate and Quadruplicate copies. No work is to be commenced or purchases made on this request until receipt by you of returned Original, duly approved by an Executive Officer, in space provided above, except in instances where urgent necessity requires immediate action. On completion of work authorized information called for on the reverse side of Quadruplicate copy is to be filled in, using the reverse side of the Original for a carbon copy. The Quadruplicate is then to be forwarded to the New York Office.

Form 44: Application for an appropriation, duly authorized.

a considerable number of similar economies that the company could be sure of realizing a saving. While, therefore, the estimate was accepted, the actual securing of a saving of $94.50 was regarded with some doubt. About the other item, however, there was no such question. Actual experiments had been made with equipment of the new type, and it was demonstrable that a definite recovery of the chemical in question could be made, over and above that obtained from existing equipment, and the value of this material was considerable. The saving on material account was substantially in excess of the annual carrying charges on the new equipment, and anything which could be realized as a saving of labor would be so much extra advantage.

Costing the Job

On the back of the several copies of the application for appropriation was a cost sheet, as illustrated below.



NEW YORK ACCOUNTING DEPARTMENT RECORD

APPROPRIATION NO. 75 879 AMOUNT AUTHORIZED $ 550.00 CLOSED February 8. 19 34

DISTRIBUTION OF EXPENDITURES

DATE	ENTRY NO	VOUCHER NO	VENDOR OR ACCOUNT	ITEM NO	MATERIAL		LABOR		OTHER ITEMS		TOTAL COST		FINAL DIST
			Requisition No. R3649	1	98	40							
			" " R3655	2	13	52							
			" " R3667	3	67	81							
			" " R3671	4	15	20							
			Total Materials		194	93					194	93	
			Job Tickets x 395-99				24	30					
			" " x 408-13				10	22					
			" " x 415-22				43	16					
			" " x 425-28				31	02					
			" " x 440-51				26	94					
			" " x 457-60				14	83					
			" " x 472-77				60	40					
			" " x 479-81				16	25					
			Total Labor				227	12			227	12	
			Trucking - O'Donnell						8	75	8	75	
			Overhead 51% of Labor								115	83	
			Total								546	63	

An additional authorization will be required for any expenditures necessary to complete.

Columns are provided above under "Distribution of Expenditures" for the purpose of accumulating these charges according to the classification. The expenditures must be entered daily in the proper column.

Form 45: Cost record showing costs on an appropriation.

All expenses for labor, materials used, and other items were entered on this form, arranged as shown, and the total cost of the job was thus ascertained. It will be noted that a burden charge of 51 per cent of the labor is included. This is one of the plants where the entire burden of the maintenance department for the month is allocated over the work done during the month, by the computation of an actual burden rate.

On big jobs of this sort monthly progress reports are also made showing the expenditures made up to the end of the month and the degree of completion of the work. All these construction jobs were in this way kept under close observation. If it were expected that any of them would involve more expense than the appropriation, an additional appropriation had to be applied for.

Measuring Results Obtained

After the equipment has been completed and is in operation, the task remains of finding out whether the actual results are as they were estimated when the new equipment or other work was authorized. A great variety of conditions occur in practice; in some cases it is possible to measure the results very definitely, while in other cases it is only possible to indicate the advantages in a general way.

When the expenditures are sufficiently large and are undertaken in connection with the development of a new product, it is sometimes the practice to gather the costs as debits to a special account bearing the name of the product. As the product is manufactured and sold, the special development account is written off in periodic charges against the sales of that product, and a definite answer is thus found to the question whether the development work paid for itself or not.

Sometimes it is possible to show the advantages in engineering terms, when the money saving cannot be measured. The following paragraphs indicate what was done in regard to following up three different items which appeared, under the general class "cost-reducing appropriations," among the work of the maintenance department of a big plant.

1. An old-type turbine was replaced with a newer and more efficient model, designed to reduce power costs. The engineering data on the performance of this piece of equipment proved

conclusively that the savings in power costs would be real; it was also shown that the company could in fact use all the power to be produced, and the replacement was made. No further costs were kept on this item, as to its individual performance, since such results would merely repeat what was already known.

2. When new welding equipment was proposed, it was felt that no conclusive answer could be found except by making laboratory tests on a small scale with the type of new equipment suggested. These experiments were made and showed to the satisfaction of all that cost reductions would result from the adoption of the new equipment. It was, therefore, installed and no further figures were kept for the specific purpose of finding what its cost performance might be, as this was considered to be already proved.

3. A considerable new installation was proposed for the purpose of reclaiming chemical materials used in large quantities. The chemical had been escaping in gaseous form into the atmosphere and the attempted recovery of it was a considerable and expensive undertaking. Experiments were conducted to learn as much about the subject as possible, and it was finally decided to make the installation at one plant. The reclamation equipment was then treated as a separate service department of that plant; careful costs were kept of its operation, and the quantities of chemical recovered were also measured with care. At the time of the installation nobody could say with certainty just what the financial results would be; the subsequent costing, however, indicated very clearly that it was a profitable venture, and installations of the same kind were set up in other plants belonging to the company.

QUESTIONS AND PROBLEMS

1. Explain clearly each item in the account shown on page 240.

2. Prepare appropriate forms, and record the following transactions of the Prospect Company:

April 16, 1923. The company purchased a punching machine from Parsons and Priddy, machine tool builders. The machine itself cost $3,000, with $83 for transportation charges. The cost of preparing a cement foundation to receive the machine amounted to $56 and the costs of setting up the machine ready for use were $21. The machine was estimated to have a useful life of 12 years, and, since it was not expected that it would be moved during its useful life, it was decided to apply the same depreciation rate to the cost of the machine itself and to all supplementary charges.

Depreciation is written off annually, on December 31, at the full rate applied to the amount of the account on the last day of each year.

June 16, 1924. The machine was found to be not functioning well; adjustments and repairs amounting to $300 were found necessary.

November 28, 1926. Certain new and improved parts were installed in this machine, which was at the same time completely rebuilt. This was expected to result both in increased production by the machine and also in lengthening its useful life.

Reserve for Maintenance

1934				1934			
Jan.	31	Sundries	365	Jan.	31	Burden Expense	450
	31	Balance	85				
			450				450
Feb.	28	Sundries	475	Feb.	1	Balance	85
	28	Balance	60		28	Burden Expense	450
			535				535
Mar.	31	Sundries	545	Mar.	1	Balance	60
					31	Burden Expense	450
					31	Balance	35
			545				545
Apr.	1	Balance	35				

3. What is the meaning of the statement (page 238) concerning charging the costs of developing a new product, and then writing it off against sales of that product, that "a definite answer is thus found to the question whether the development work paid for itself or not"? Illustrate your answer by showing typical debits and credits to the account for Product Development 39X, explaining each item and the balance.

4. The total expenses of the mechanical or maintenance department of the Leader and Driver Leather Company for November, 1933, were summarized as follows:

Direct Materials Used	$3,630
Direct Labor	2,370
Overhead of Mechanical Department	1,500

When the repair and construction orders were summarized for the month on the basis of departments the results were as follows; only direct materials and direct labor were charged to individual jobs.

ANALYSIS OF MECHANICAL DEPARTMENT JOB COSTS
SUMMARY FOR NOVEMBER, 1933

	Repairs and maintenance	New construction	Machine stores inventory
Hide house	$ 367		
Beam house	294	$ 254	
Tan yard	580		
Splitting and shaving	733	690	
Coloring and fat-liquoring	596		
Drying	590		
Tacking	478		
Finishing	265		
General plant burden	413	539	
Machine stores			$201
Totals	$4,316	$1,483	$201

Set up ledger accounts for the mechanical department, for the overhead of the direct departments, and such other accounts as are necessary to record the foregoing analysis. Enter in these accounts the summary information given for the mechanical department.

5. Suppose in the foregoing case it were ascertained that the average or normal monthly expenditures for repairs and maintenance in the several departments were as follows:

Hide house	$ 350
Beam house	300
Tan yard	600
Splitting and shaving	600
Coloring and fat-liquoring	500
Drying	500
Tacking	300
Finishing	300
General plant burden	400
Total	$3,850

Can you suggest any method by which these figures might be used in the accounts? Explain your procedure exactly, and point out how it differs from the method followed in the preceding question.

XIV

COMMERCIAL AND ADMINISTRATIVE OVERHEAD

Just as manufacturing overhead tends to increase as a proportion of total manufacturing cost, so also does the added cost for the selling of the product and the administration of the business as a whole tend to increase. It is well-known that in many businesses these post-manufacturing expenses are as large as the factory costs proper; it is equally well-known that they have not as yet been given anything like the same analysis and investigation by accountants. This is partly because problems of manufacturing costs forced themselves upon the attention of executives earlier than did the corresponding problems of administrative and selling costs; it is partly due to the fact that the two latter groups are in some ways more difficult of analysis than are manufacturing costs. Neither of these reasons will, however, justify the continued avoidance of these problems, and as a matter of fact business men are giving increasing attention to them. Many companies have already accomplished considerable successes in effecting a working control of these groups of expenses as a result of careful study of their nature and contents, the purposes they are intended to serve, and the results obtained from each expenditure. A proper attitude toward this question was well expressed by one executive who stated that every dollar of expenditure in this field should be made to do 100 cents' worth of work, but that in applying this principle it should be recognized that a creative spirit, the spirit of growth, is a vital necessity in every business, the preservation of which is one of the main functions of a wise administration.[1]

Place of Administrative Costs in the Business

There are two principal methods of dealing with administrative costs. The first is based on the view that the administration of the business is a function separate and distinct from those of manufacturing and selling; while it is considered by those who support the view that manufacturing and selling are the operations which are being administered, yet it is contended that the connection between the administrative expenses and the operating departments is too indefinite, too remote, to be measured by accountants in any practical way, and that it is better not to confuse selling and manufacturing costs by including in them such arbitrary allocations of administration expense as are frequently made. In other words, it is contended that administrative costs are better kept separate and distinct both for purposes of their control and also for building up selling prices for specific products.

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[1] National Association of Cost Accountants, 1924 *Yearbook*, p. 278.

The other line of thought maintains that the main functions of a manufacturing concern are production and selling, and that administration is a necessary auxiliary to these two main functions. It is believed desirable to show the total cost of manufacturing and the total cost of selling, including in each the appropriate share of general administrative expenses. It is also contended that, in building up a total cost to make and sell, which can be used as a basis for a fair selling price, the treatment of administrative expense is facilitated by this absorption within the two main groups of manufacturing and selling expenses.

Both of these theories have eminent practical exponents, from which we may judge that one method is likely to be satisfactory in some cases and the other method more satisfactory in other cases. If a reasonable basis can be found for dividing administrative costs between manufacturing and selling, that process is likely to be of benefit; but if such an allocation is purely arbitrary, it will be more satisfactory to retain administrative expenses as a separate group. The only essential thing is that they shall be well analyzed both for purposes of control and for allocation between the various lines of product.

Content of Administrative Costs

Before administrative costs can be discussed it is well to understand precisely what they contain. If all expenses properly pertaining to the manufacturing and selling functions have been allocated to them, then administrative expense must, of course, contain all that is left. The principal items included in it will be somewhat as follows: (1) salaries and expenses of the executive officers of the company; (2) corporate expenses of the company, including all activities of the secretary's department; (3) accounting and financial expenses, including the credit department, all expenses of collecting and handling the company's funds, and the general accounting;. (4) development work of a general kind which cannot well be charged to manufacturing or selling.

Basis of Division of Administrative into Manufacturing and Selling

As already stated, it is not usually possible to make a very exact division of administrative expense into manufacturing and selling. In some cases, however, when it is desired to do this, the administrative expenses should be listed in some detail, and the division should proceed on a basis similar to that followed in distributing manufacturing burden. That is to say, satisfactory results are not likely to be obtained by considering administrative expense in general, but rather by considering each item of the expense. Salaries of executives, for example, may be divided according to the approximate share of their time and effort which the executives devote to each division. No exact measurement of this should be attempted, but it is not difficult to ascertain whether the major problems of the business are on the manufacturing side or on the selling side, and to make an allocation which would be near enough. Similarly with the general accounting: assuming that cost accounting has already been included in manufacturing burden, the general accounting is perhaps more likely to be connected with selling than with manufacturing, but in some cases the general accounting also deals predominantly with transactions involved in the manufacturing operations, and this department will therefore be charged mostly to manufacturing. By thus considering each item separately, a satisfactory distribution of the total may be reached.

Distribution of Administrative Costs to Goods Sold

Probably the commonest method for distributing administrative costs is to compute the percentage which the total of these costs bears to total sales and use that percentage in determining a charge to specific lines. A little study and analysis will, however, usually enable a considerable portion of the expenses to be allocated more definitely in proportion to service rendered in the routine departments, for example, such as the sales billings and the voucher department. A fair determination of the expenses allocable to a given line of goods or to a given department would be the number of items handled, in the case of sales accounting the number of invoices compared with the total number, and in the voucher department the number of incoming bills for a certain department compared with the total number. A considerable part of the clerical expenses could be equitably disposed of in this way. With regard to salaries of general executives the only fair basis would be to take observations of the way in which they spent their time, a matter in which the executives themselves would have to be consulted. The figures for one year would not be a very reliable basis for this purpose; observations should be taken for several years in order to get a representative view of this subject. When all such possibilities of analysis have been exhausted there is likely to be a considerable residue of expense which can be handled only by an arbitrary prorating to the departments which may be charged.

Expense Items Allotted to Selling or Administrative

It frequently occurs that sales offices and administrative offices are joined together and have many operations and expenses in common. It then becomes desirable to segregate the two groups. As in all cases of allocation, the division is helped by itemizing the expenses in detail. Many of the items will then be found to be entirely selling or entirely administrative. Thus items which clearly belong in both divisions may be allocated on a roughly sound basis. As an example of this the following division was made in the offices of a manufacturing concern:

DIVISION OF SELLING AND ADMINISTRATIVE EXPENSES

Selling expenses to include:	Administrative expenses to include:
Selling salaries	Purchase expense
Export salaries	Credit
Shipping salaries	Financial and accounting
Order salaries	Porters
Branch office expense	Administrative salaries
Commissions to salesmen	Officers' salaries
Traveling expenses, salesmen	Attorneys' collection charges
Advertising	Legal expenses

- Export brokerage
- Export expenses
- Service charge, federated
- Miscellaneous selling expenses
- Telephone and telegraph
- Cables
- Membership subscriptions and mercantile reports
- Insurance, selective credit
- Two-thirds of the following:
  - Light
  - Rent
  - Insurance, fire, on furniture and fixtures
  - Insurance, group
  - Office supplies

- Postage
- Auditing
- Bank collection and exchange
- Directors' fees
- Charities and donations
- Traveling, general
- Miscellaneous administration
- Depreciation, furniture and fixtures
- Provision for doubtful accounts
- Anticipation allowed trade debtors
- Franchise taxes
- One-third of the following:
  - Light
  - Rent
  - Insurance, fire, on furniture and fixtures
  - Insurance, group
  - Office supplies

Commenting upon the above list it would seem that depreciation of furniture and fixtures might be added to those items at the end which are divided two-thirds to selling and one-third to administrative. "Anticipation allowed trade debtors" means a further allowance, computed on an interest basis, over and above the regular cash discounts, made to customers who paid their debts in advance of the discount date.

Sales Expense and Sales Executives

The problem of distributing selling expenses is susceptible of more definite treatment than that of the handling of administrative expenses, but it can be successfully dealt with only if those making the analyses will work in harmony with the managers responsible for the sales activities; it is to the failure to develop cooperation here that weaknesses in handling this subject may largely be attributed. The fault has lain on both sides; the sales cost analysts have failed to acquire the viewpoint and interests of the sales managers, and the latter have regarded such analyses as a nuisance, an interruption of their main work. The difficulty has been increased, on the one hand, because there frequently has been no organization specifically charged with the duty of making these analyses; the cost department has considered its activities to be confined within the factory walls, and, unless the sales managers have been prepared to install people in their own departments for this purpose, it has tended to be neglected. As a matter of fact, however, more and more of the prominent firms are making such analyses, and increasing competition makes them a practical necessity. It is no longer possible to assume that losses sustained on one line of goods will be reimbursed by making ample profits on another line; each line must be watched and made to carry its share of the load; or, if losses must be taken on some lines, it should be done with open eyes and a definite purpose in view.

Organization for Sales Expense Analysis

Sometimes question arises as to who should make these studies of sales expense, the accounting department or the sales department. It is a matter which concerns them both, and if the sales department do the work they must obtain their figures from the accounting department and then have an accounting or statistical staff of their own to make the further analyses. In practice the work is found sometimes in one department and sometimes in the other. It is felt, however, that doing this work in the sales department is an indication that the accounting department has to some extent failed to perform its full obligations. If the accounting department is headed by a man who can understand the problems of the sales department, and the sort of information they need in solving their problems, than it is better for the accounting department to handle this work, and in fact it commonly does handle the work under these conditions.

Groups of Sales Expense

As in the case of administrative expense, it is no answer to the problem to make a flat prorating of sales expense to all departments; to do so assumes that all lines bear an equal rate of selling expense and that, if the manufacturing costs also are equal, the net profits will be equal. The object of the analysis is to ascertain whether this is so or not; usually it is found that net profits on different lines vary to a surprising extent.

A beginning will usually be made by preparing a budget of expected sales and expected selling expenses; an effective control of selling expenses is not likely to be achieved unless such a plan is prepared in advance. When this has been carefully done, variations in expenses, as compared with the budgeted expenses, can be traced to their causes; if they are accompanied by corresponding variations in sales, the situation may be regarded as satisfactory, but at any rate the information is forthcoming for proper action on the part of the executives in charge.

These expenses will ordinarily consist of several main groups, which differ considerably among themselves by the extent to which they affect the costs of individual items. If the manufacturing costs have not been listed to include expenses of packing, these, together with the shipping room handling costs, become the first group of selling expenses. The next will include freight to customers or to branch warehouses. If there are warehouses at the plant, in which goods are stored either before or after being packed, the costs of operating them will constitute another group of expenses chargeable to selling. Next come the expenses of maintaining branch warehouses. The salaries, commissions, and expenses of salesmen at the head office and at branches are another group; in addition to these will be the selling overhead expenses involved in maintaining sales offices and a selling organization; this group would include the expenses of sales managers and of all clerical help connected with selling operations. Advertising will usually be another large item and so will the various other activities commonly listed under the heading of Sales Promotion.

Distribution of Sales Expenses

The enumeration of the various groups of selling expenses, as given in the preceding paragraph, suggests the mode of attacking the problem of distributing these expenses to products. A distribution of all these varied forms of expense upon the same basis is obviously erroneous and misleading; only by considering each group separately and applying them to the product on an appropriate basis can results of any value be secured. Moreover, before any distributing operations are undertaken, the purpose for which the distribution is being made should be clearly defined, and a procedure adopted which will serve that purpose.

One general division of distribution costs which is sometimes useful is that into order-getting activities, and order-filling or delivery activities; the latter includes expenses for fairly regular and routine operations, which can therefore be analyzed with some accuracy and thus be used as part of the costs of sales by lines or by groups of customers. These costs can be allocated on a basis of a fixed charge per order or per item within the orders or, for packing and physical handling, in proportion to bulk or volume.

Merchandising and Selling

The organization of the selling department varies greatly in practice, based upon the necessities of the company. Further, a variety of usage is found in the terms employed. One fairly common division of activities, and therefore of expenses, is into merchandising and selling. In this case merchandising means the preparation of goods for sale, and selling means the actual selling of the goods from that point on. For example, a manufacturer of paper novelties has several merchandising departments; their duty is to decide what products shall be made, how they may be improved in attractiveness, and in general all questions which bear upon the selling appeal of the products themselves. A manufacturer of perfumes and toilet preparations will also have a merchandising department which will be concerned both with the selection of the right goods to sell and with determining the most attractive forms of putting them up for sale. Where this organization is in vogue, it is possible to draw a fairly clear line between the expenses of merchandising and the expenses of selling. In some instances these functions are under different men, and the measurement of their performance requires that this division of expenses shall be made.

The Seasonal Distribution of Selling Expenses

The first thing to be observed is that, unless the business is one which runs along very evenly, with few fluctuations, it is not conducive to accurate results to charge selling expenses against the sales of the months in which the expenses happen to occur. The principle by which manufacturing expenses are gathered together into inventories, which are held as assets of the business and prorated over the various units of product, is a sound one; in modified form the idea may be applied to selling expenses, whenever the selling activities which involve expense are not strictly coincident with the realization of sales, as will occur mostly in businesses having a seasonal movement. It may well happen that the advertising and sales promotion expense for the entire year is very largely incurred in the spring months, and the sales made during the summer and fall months, with inactivity in the winter.

Even during the winter months, however, the selling organization must be maintained and the expenses incident to those months will be disproportionately large as compared with the volume of sales made.

For this purpose again it is desirable to prepare a budget in advance showing total estimated sales of the year and total selling expenses, with the proportion of the latter to the former. The budgeted sales should be spread over the months of the year and a corresponding percentage of selling expenses charged to those months. If the actual sales of any of the various months differed materially from the budgeted sales, a corresponding adjustment might be made in the expenses to be charged to that month. It is to be observed that there is no reference here to the allocation of expenses to particular lines; it is intended only to assign to each month a proportion of the total selling expenses of the year corresponding to the sales of that month.

In suggesting that selling expenses be thus "inventoried," it is not intended that they shall be added to the value of the merchandise inventory accounts but only that they shall be segregated into deferred asset accounts, which can be written off and charged into operations on some suitable basis. Thus freight paid on goods shipped to branch warehouses may be charged to a Freight Paid account, the goods themselves remaining in the warehouse books at cost. As these goods are sold a proportionate part of the Freight Paid account may be written off and included in the cost of sales.

In making such prorations of expense to the various months on a standard or budgeted basis, it is likely that there will be overabsorbed or unabsorbed balances at the end of the year. It is not usually desirable to carry these balances forward into a new year and the companies which adopt this general method of prorating their expenses will commonly take care that such balances are closed into profit and loss, thereby securing that all expenses of the year are charged against the year, although within the year they have been distributed over the months in proportion to business done.

Distribution by Lines of Product

Probably the most important purpose of distributing selling expenses is to figure a total cost to make and sell, upon which a selling price can be set; or conversely the selling price being determined by market conditions, the total cost to make and sell will indicate the net profit available on the several lines from those market prices or will show whether the company can continue to make that product.

Packing, shipping-room expenses, and freight can be charged to the several products as a direct cost at rates which can easily be determined. For charging salesmen's salaries and expenses, a flat percentage of sales may be used if equal attention is given to all lines; otherwise some form of time studies may be taken to determine the proportion of time given to the various lines, which will be charged accordingly. The indirect expenses of the sales department may be charged in the same proportion as the direct salesmen's expense; the last two sentences apply to selling done either from the head office or from branches. Warehousing expense may be charged in proportion to the volume occupied by the various lines. Advertising either deals with specific goods or is of the institutional character; the former may be charged to the lines concerned and the latter may be spread over them as a flat percentage either of sales or of total selling expenses prior to this point. If administrative expenses have also been included, these distributions will, when added to the manufacturing cost, give the total cost of placing goods in the hands of customers and thus will make it possible to show a net profit or loss on the several lines.

Direct and Indirect Selling Expenses

As with manufacturing expenses, selling expenses may be divided roughly into those which may be charged directly to a product or line and those indirect expenses which are common to all lines. If the former class is allocated specifically to the products affected, it will often be found that they amount to 50 per cent or more of all selling expenses. Some companies have found it satisfactory to make a distribution of selling expenses to lines of product up to this point and then compute the profit by lines. The remaining general selling expense may then be prorated to lines of product in proportion to the volume of sales; or, if this is considered fruitless, they may be deducted in total from the total amount of profit shown on all lines after deducting the direct expenses. In either case the allocation of direct expenses to products has given more reliable figures of profit by lines than can be obtained by an arbitrary prorating of all selling expense.

Distribution of Branch Selling Expenses

The expenses of a branch, other than the salaries and expenses of direct salesmen, will consist of salaries of the manager and of the clerical staff and the general maintenance and upkeep of the offices and warehouse. When the total of these has been ascertained for any period, it can first be compared with the budgeted expenses for the branch, comparing actual sales with budgeted sales at the same time. For purposes of further distribution the total expenses may, however, be divided by the total number of items billed by the branch, thus securing a per item charge, which also may be compared with a standard figure.

Profit and Loss Accounts by Districts

Where sales campaigns are organized on a territorial basis, with responsibility for results in specific districts allocated to definite salesmen or district sales offices, it is often desirable that profit and loss accounts should be prepared on a district basis. For this purpose, sales must be tabulated by districts; the standard manufacturing cost is deducted to give the gross profit. An allocation of head office selling administrative expense is then made, after which the direct expenses of the district or branch office are deducted, thus arriving at the net profit. Head office selling and administrative expense are in some cases allocated to districts on the basis of sales, in other cases on the basis of cost of sales. Probably sales is the better basis, since the sales figures include the aggregate values which are being sought after when the organization and sales campaigns are prepared. The cost figures, on the other hand, represent only the manufacturing costs, which bear little or no relation to the head office selling and administrative expenses. It seems fair to assume that these head office expenditures are undertaken for the purpose of securing the revenues reflected in the sales figures, and that they may therefore be allocated in proportion as these sales are obtained.

It does not necessarily follow that these district profit and loss accounts will be furnished to the district managers or sales offices; in most cases this will not be done, as it is thought desirable to furnish figures on manufacturing costs in general to the sales offices. In other words, the main purpose of such district profit and loss accounts is to assist the sales department at the head office in their work of sales management. From these statements they can determine which of the district sales offices are effective and successful and which are not. They may decide that a different appropriation of advertising expense is necessary, more in one district and less in another; or it may be discovered that the wrong products are being pushed in some of the districts. In other words, the general direction of sales effort may be much facilitated by a study of these profit and loss statements, whereas they may not be of any particular service to the actual salesmen in the districts.

Distribution of Expenses by Salesmen

The total cost of a salesman to the business includes his salary and commission, traveling and other expenses, plus a share of the general overhead expense of the office or branch to which he is attached. When the total of these overhead expenses has been ascertained, it may be apportioned among different salesmen either on the basis of total sales or at a charge per item for all the items billed to the customers of each salesman.

When the total costs of a salesman have been ascertained, they may be divided by the number of calls he has made, and by the total sales he has made, for the purpose of getting a cost per call and a cost per dollar of sales, these factors being among the most significant indexes of the salesmen's worth to the company.

If any accurate cost of selling different lines is desired, it is necessary for salesmen to keep time records of their efforts which will indicate the amount of time devoted to each line of product. There is some difficulty in making this time record very accurate, but a number of companies have considered the matter of sufficient importance to pay continuous attention to it, and these have secured reasonably reliable data. When time studies are made of salesmen's activities, some other interesting facts are usually ascertained, in addition to the cost per call, cost per customer, or cost by lines of goods. Information is also acquired as to the percentage of the salesmen's total time that is actually spent with customers, the percentage devoted to traveling, the percentage for waiting about to see customers, and the percentage for writing reports and doing other clerical work. Such information is used by some companies as a basis for endeavors to increase the effectiveness of salesmen by increasing the percentage of time they actually spend with customers and reducing the proportion of their time devoted to nonproductive work.

The total salaries and expenses of all salesmen attached to any one branch or sales office, when added to the indirect expenses of that branch or office, as described in the preceding section, will give the total expenses of a branch, which can be computed as a percentage of the total sales of the branch and otherwise checked with the figures estimated in the budget.

Distribution of Expense to Customers

By assembling the figures discussed in the preceding paragraphs in a somewhat different arrangement, a total cost of selling to each customer may be secured, which, with the total manufacturing costs, may be deducted from the sales to that customer to indicate his profitableness to the business. Thus the cost per call made upon him has been figured in the report on the salesman who visits him; the cost per item billed to him is shown in the analysis of the sales office or branch office expenses. The costs of packing and shipping have also been analyzed to a point where they can be applied to individual customers. Many companies have found that their volume of business is done with a minority in number of their customers, the business with all the rest of the customers being border-line cases or actually unprofitable. This does not mean that they can be discarded; these apparently unprofitable customers may, taken as a whole, buy just that volume of business which is necessary to convert the company as a whole into a profitable concern. There is, moreover, always the chance that smaller customers may be developed into more paying ones. While, therefore, it is not expected that arbitrary action will be taken on the basis of the cost figures relating to individual customers, it is likely that a more intelligent handling of those customers can be had as a result of the figures.

Distribution of Expenses by Classes of Customers

In all expense distributions of this sort it is important to follow the lines of the organization and make distributions which will have the result of measuring the satisfactory or unsatisfactory discharge of responsibility. Some of the largest corporations in the country have their sales departments organized into divisions which take care of the business of different classes of customers; wholesale dealers may be handled in one division of the sales department, retail dealers in another division, large manufacturers using the company's product in another division, and so on. It follows, then, that the divisional expenses will indicate the costs of selling the different classes of customers and will permit of making a computation which will indicate their relative profitableness.

Another grouping of customers which may be useful to the sales management is along lines of the frequency with which they buy, or the average size of their orders, or the ease of selling them. There are at one extreme customers who buy the company's products freely and regularly without any fuss; there are at the other extreme those customers who have to be coaxed into buying every time they place an order, or who perhaps will never buy unless they receive some special concessions. Here again no hard and fast rule can be laid down for the handling of these different groups, but it is certain that with this information the sales department can direct its efforts to better effect.

Size of Customers' Orders

Some of the most striking results in the analysis of selling expenses have come from grouping orders according to size, and then computing the cost of each group; this is not quite the same thing as the grouping of customers by the amount of business done with each, though it may turn out to be very similar in results. By such studies it has many times been demonstrated that an order has to be above a certain amount before it will pay to handle it; that is to say, the expense of handling small orders will exceed the gross profit on them. It will not necessarily follow that small orders will be refused; they may be continued at a loss as a matter of policy, as an accommodation to customers; or prices on small quantities may be increased to the point where they yield a profit or at least more nearly pay for themselves. Another course would be to instruct salesmen to seek to avoid small orders, without actually refusing them. Many courses of action are open, when one has the facts available; it is ignorance of the situation which is harmful.

Unit Costs of Selling Operations

It will often assist in making studies of the sort described in the preceding paragraphs if figures are gathered to show the cost of performing some of the more elementary operations connected with selling. How much does it cost, on the average, for a traveling salesman to call on a customer? How much does it cost to obtain an order from a customer by a salesman's call or by mail? How much does it cost to transmit this order through all stages of office work to the manufacturing department? After the order has been completed, what is the cost of preparing an invoice for it? What does it cost to carry a selling agent's account, wholesale or retail, including credit investigations, accounting records, and correspondence? These figures will, of course, be very different for different companies and for different lines of industry. But when these unit figures have been ascertained, they may often be put together in different relationships to help to answer questions about methods of marketing.

A Concrete Case

The kind of problem which arises in connection with distribution costs is well illustrated by an example which occurred in a textile selling house. In addition to the ordinary run of textiles the house was selling certain types of cloth to manufacturers, for use in their operations; in other words, they were industrial goods rather than consumer goods. The selling house was handling these goods for the manufacturers on a straight commission basis and for some years had the impression that it probably was not making money on this division. There were two main departments in the selling house, which may be called Department M and Department S; the special industrial product may be called Product 16 and was one division of Department M. There were three different lines of Product 16, sold at different rates of commission or trade discount. The gross income on these lines was, therefore, specifically known, since the trade discounts received were 12, 10, and 9 per cent, respectively. What was needed was an allocation of the selling house's expenses on a basis which would give the cost of handling the several parts of Product 16.

The Expense Allocation

This task was undertaken as follows. In the first place the division of expenses between Department M and Department S was easy, since two separate sets of expense accounts were kept for these in the general ledger. From these accounts, therefore, the total expenses of Department M were available. The next step was to divide these total expenses between Product 16 and other products handled in Department M; in doing this it was desirable to segregate the three parts of Product 16, marked 16*a*, 16*b*, and 16*c*, respectively, to give effect to the three rates of trade discount. Two different bases were selected for this purpose: (1) the volume of sales in dollars and (2) the number of invoices issued for each group of products. On the first basis the total expenses of Department M were allocated to Products 16*a*, 16*b*, 16*c*, and other products in proportion to the amount of sales of these products; when the expenses thus allocated to the three parts of Product 16 were matched against the gross income from those products, it appeared that each one of them showed a small net loss. The second method, the number of invoices, was chosen for the purpose of giving effect to differences in the size of individual orders and the expense of handling them. On this basis the total expenses of Department M were allocated to the several subdivisions in proportion to the number of invoices issued for each. When the expenses thus charged to Product 16 were compared with the gross incomes for the product, two of the divisions of Product 16 showed larger losses than by the other method, and one division showed a small profit. An example of this operation, with some figures, is given as an exercise on page 259.

The attitude of the management on these findings was that the truth probably lay between the two results, and that these represented the outside limits of fact. In other words, they concluded that this product was indeed a losing venture and that some radical reorganization of the handling of it was required.

Other Classifications of Selling Expense

Another grouping of selling expenses which has been found useful is into selling expenses, sales promotion expense, and advertising. Broadly speaking, these classes resemble the order-getting and order-filling activities which have already been described; but it is more pertinent to say that they are used most effectively when they correspond to three different groups of officials in the company organization. When one group has charge of selling, another of general sales promotion work, and a third of advertising, then it is natural and reasonable to charge to each group the expenses of the operations for which it is responsible. This will not necessarily mean that the divisions between the groups coincide with any particular definitions; it will mean only that all expenses will be charged simply where the responsibility for them lies.

Questions and Problems

1. If a company finds that small orders for goods are unprofitable, while larger orders for the same goods at the same price are profitable, what are the probable reasons for that condition? What items would you name as contributing to that result, and what steps, if any, would you take in the matter?
2. Of what value is it for a company to distribute its total selling expenses to all lines which it sells, at a flat rate per cent? Are there any circumstances in which it might be of considerable value?
3. What are the principal items of administrative expense? In what different ways may this class of expense be handled, when considering the profitableness of different classes of business?
4. Which figures are likely to be more accurate, selling costs or manufacturing costs? Give reasons for your answer.
5. If you were selling a food product, with a national distribution, with warehouse stocks at 37 central points, and district sales offices in 28 cities, what figures would you think it well to gather regarding sales and their profitableness?
6. Should all the selling expenses of every month be charged against the business done in that month? Give reasons.
7. Why is it desirable to know the costs, by products, of selling and administrative expenses?
8. The Collins Company manufactures one main product and two by-products. Its salesmen sell to wholesalers throughout the country and are paid on a straight salary basis. The majority of the customers buy the main product; some buy the main product and one or both of the by-products; a few buy one or both of the by-products and not the main product. What basis would you suggest for distributing the salesmen's salaries to the products?

9. Why are selling and administrative expenses not usually included as part of the "cost of goods sold" on the profit and loss statement, or in the cost records? When may they be included?

10. Referring to the case described on page 257, make computations along the lines there described, to show the approximate profit or loss on the three products, 16*a*, 16*b*, and 16*c*, using the following data:

Total Selling and Administrative Expenses

Department M	$ 29,362.40
Department S	78,407.70
Total	$107,770.10

Product 16 was sold in Department M, the figures relating thereto being as follows:

	Sales Department M	Number of invoices
Product 16*a*	$110,000	1,500
Product 16*b*	20,000	1,200
Product 16*c*	30,000	1,700
Total Product 16	$160,000	4,400
Other products	600,000	7,600
Total Department M	$760,000	12,000

On Products 16*a*, 16*b*, and 16*c* the company was allowed by the manufacturers trade discounts of 12, 10, and 9 per cent, respectively. The company managers were desirous of knowing whether the line was profitable or not.

Prepare tables which will help to answer this question.

XV

SUMMARIZING THE COSTS

The Main Plan of Costing

The preceding chapters have described how the original records for material and labor costs are made and how the burden expenses may be distributed. It is now necessary to consider how these various cost items are summarized to provide the total cost of finished products. The method of gathering the figures depends entirely upon the nature of the manufacturing operations, upon the method of ordering the manufacture of the products and of routing them through the works.

Basic Units for Costing

Before attempting any cost gathering it is important to select the best units on which to compute the cost figures. Naturally these units will often be expressed in terms of quantities of the final product, but this is by no means always so, and it may well happen that in the same plant different units serve as the basis for costing at different stages in the process. In textile industries, for example, costs up to the weaving process are stated on a per pound basis; for weaving and later processes they are stated per yard. In some chemical industries the earlier processes handling liquid solutions may be costed on a per gallon basis, but later, when reduced to solids or powders, on a per pound basis. Even when such a change occurs in the character of the product, from liquids to solids, the cost figures will be carried right through on a per pound basis, where it is possible at all points to convert the liquid measures into a dry content. This is true, for example, in paper making, where so many pounds of rags, sulphite pulp, shavings, or other materials may be entered into process, carried in solution form through certain stages, but come out in the end as so many pounds of paper.

An example where the cost units are not stated in terms of the final product is found in the printing industry, where the printer is not primarily interested in the cost per book or per printed page. The costs of a printing job are broken down into hours of work of different operations, such as an hour of typesetting by hand, an hour of typesetting by machine, or an hour of running any one of the printing presses or other pieces of machinery. These hourly rates are figured to include all costs of doing the work specified, the labor, and all expenses of operating the equipment. The costs of a printing job are then stated (in addition to materials) as so many hours of composition, so many hours of making ready or preparing the machines, and so many hours of running the machines.

Other Examples of Cost Units

The variety of cost unit to be found among the various industries is well illustrated by the following list which is only a brief sample of what a complete list would be.

	Unit
1. Brewing industry:	
a. Brewery	1 bbl.—31 gal.
b. Bottling plant	1 case—12 or 24 bottles
2. Soap industry:	
a. Costs during process	per hundredweight
b. After packing	per case
3. Pharmaceutical industry	per thousand units of each item
4. Sole leather tannery	per pound
5. Automobiles and trucks:	
a. During process	per part (in various numbers)
b. Finished product	per car or truck
6. Cigars	per thousand
7. Hosiery mill	per dozen pairs or per gross pairs
8. Baking industry	per 100 lb.
9. Manufacturing jewelers and silversmiths	Unit varies from one to a gross depending upon the size of the product and of the typical order
10. Leather bookbinding plant	per thousand
11. Newsprint manufacturing	per ton
12. Motion picture industry	per picture
13. Mining industry	per ton

Quantities to Be Costed

It will be observed that the previous discussion relates to the specific item or unit to be used in expressing the costs. A related question is: What quantity of these units, or of finished product, shall be costed in any one lot? Another form of this question is: What quantity of product shall be included in any one cost sheet, the sheet on which costs of production are usually assembled? The answer to this question leads directly to a discussion of the two common methods of costing, job costs and process costs.

Job Costs

In some businesses, for example, goods are made one lot at a time, or even one item at a time. This is especially true when goods are made for customers' orders, but it may also be true when they are made for stock. Thus a manufacturer of special weighing machinery is likely to make a machine only when he gets an order for one from a customer, who will specify exactly what he wants on it, and what duties he wants it to perform. To get that order, the manufacturer doubtless had to quote a price to the customer. The order is sent into the factory, which then makes that machine specially for that customer. In doing so they also gather the costs of it, partly to compare with the price they quoted to the customer and partly for future use. Where every separate manufacturing order is costed in this way, it is said that the manufacturer is using job costs. A commercial printer uses job costs; he receives orders to print catalogues, pamphlets, books, or posters, and each order is a separate job, both as it goes through the works and for costing purposes. A contractor keeps job costs, in order that he may know the cost and the profit for each job.

Process Costs

In other types of business, goods are not made by separate units or separate lots, and therefore they are not costed by separate units or lots. These are the plants where goods flow along in continuous process, so that it is not possible or desirable to identify or figure on any one unit. The process may be carried on for a long time without change. In this case the cost accounting is designed to show the costs of carrying on the process, usually for the period of one month. A flour mill is an example of this sort of operation, and another example is a cement mill. In these the materials flow continuously through the processes; nobody is interested in the cost of any one barrel of flour or bag of cement. The management is, however, interested in the total costs of operations and in the average unit cost for all bags or barrels produced during the period. When, therefore, all the material, labor, and burden costs of the process for the period have been summarized, the total quantity produced during the period is divided into the total costs, thus showing a cost per pound, per gallon, per barrel, or any other unit which may be used.

There are many variations in these two main types, and frequently both are used in different departments of the same plant. Even where goods are made in lots, each lot being on a separate manufacturing order, if those lots represent a limited number of standardized products, it is possible that the management will not think it worth while to gather the cost of each individual lot but instead will gather product costs. This means that there will be an account or summary for each product, to which will be charged all materials and labor devoted to that product during the month, and a corresponding amount of burden.

Continuous Detailed Costs or Totals Only

One of the most important questions to be determined is whether continuous costs, that is to say, the cost of every individual lot, shall be kept or whether it is sufficient to record total costs which, when compared with the production of the department, would indicate when the cost was out of line. Whenever the manufacturing processes are standardized and continuous, there is an opportunity to do away with the detailed costing of individual lots. It will be known that if a certain speed of manufacture is obtained the cost will be so much; apart from spoiling or wasting materials, variations in cost can come only from variations in the expense items, which may easily be observed, from changing the process, or from varying the output per day.[1] In other words, the procedure is a form of process costs.

Summarizing Costs under Mass Production

As an example of how production methods bear upon the method of cost gathering, reference may be made to the automobile industry. Here parts are made by continuous automatic processes, and these parts are put together into sub-assemblies and main assemblies with the aid of traveling belts, moving platforms, and other mechanical devices. When such an assembly line has been laid down, every operator along the line contributes his little bit to the result, but no one of them does very much. Moreover, the whole line is timed to run at a certain speed, and the number of assemblies to be handled, and therefore the rate of handling them, is worked out by the engineers. Men on such work are usually paid on hourly rates or some modification of them, such as hourly rates plus a bonus. The cost of making a part or assembly under such conditions is a very simple thing to find; it is the total cost of operating the line for one hour, divided by the number of pieces produced per hour. It is not necessary to keep cost figures for each piece or even for each lot; as long as the moving belt or platform is kept traveling at the specified speed, and the rates of pay and other expenses remain unchanged, the cost of the unit of product cannot change. The same is true of manufacturing efficiency; as long as the rate of operation set by the engineers is maintained, efficiency is 100 per cent; no one operator can change the total result, and inefficiency on the whole group means stoppages or breakdowns of the entire system.

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[1] See description of Packard Motor Car Company methods, *Factory, the Magazine of Management*, October, November, and December, 1924.

Standard Costs

It is in such circumstances as this that standard costs are especially useful. The entire Chapter XXI is devoted to this subject, but standard costs have become so fundamental an idea in all cost work that the main principle of them may well be illustrated here. Suppose that an assembly line has been planned for 40 people to operate at a moving table on which they are to build a certain type of battery, then actual experience may show that the hourly cost of this work, when everything is going satisfactorily, is as follows:

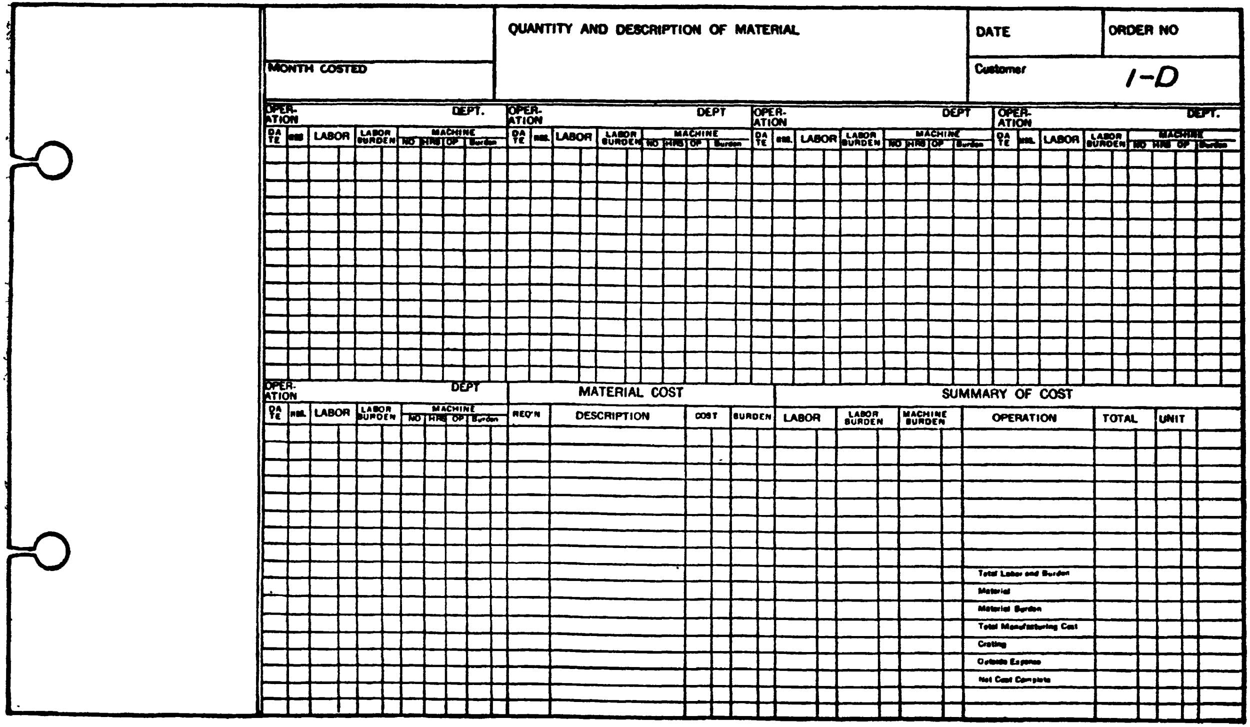
Wages of 40 operatives	$21.60
Space or rental charges	14.75
Depreciation, taxes, insurance of equipment	18.30
Repairs and maintenance	16.00
Total	$71.55

Suppose that the table and the operatives are all geared for batteries to be completed at the rate of 100 per hour, then the cost of making one battery, exclusive of materials, is $71.55

divided by 100, or 71.55 cents per battery. This figure might well be regarded as a standard cost; it could be used in considering the fixing of selling prices; still more could it be used as a base for measuring the efficiency of operations. If, for example, at the end of a given month, the figures showed that the hourly cost of this assembly had averaged 72.10 cents, then there have been excess costs of 55¢ per hour, and it will be of interest to the management to find out just where and why this has occurred. It may have been necessary to revise the line and to add another man or two; some increases in wages may have been awarded; there may have been more stoppages during operations than were figured on; perhaps it was not found possible to maintain the planned rate of speed continuously; some of the items of overhead costs may have increased. At any rate, here is a clear case where a certain cost was laid down and aimed at as standard performance; that standard can be used as a mark to be reached or bettered, as an incentive for the operatives and a basis for measurement by the management, as long as that operation is conducted in that way. Many other phases of standard costs are discussed later, but this basis of comparison is the central idea. Moreover, it removes the necessity for the management to bother about the cost of each individual battery, or to watch each item of expense in detail. As long as the total costs amount to 71.55 cents per hour of operation, they know that all is going as planned; if the costs vary from that figure, the reasons for those variations should be stated in simple terms; the management would then have conditions very effectively under control.

Job Cost Sheets

The differences between the various types of cost accumulation are clearly demonstrated in the respective cost sheets used under each. A cost sheet is a summary of the costs of a given lot of product. Under the job or order method of costing, one cost sheet represents a job; on it are entered the materials issued for that job as shown by the requisitions, the labor put on the job as shown by the labor tickets for individual employees, and a prorated amount of burden, usually in proportion to the labor. Form 46 is an example; it is the job cost sheet used in a paper-box factory.



MONTH COSTED

QUANTITY AND DESCRIPTION OF MATERIAL

DATE

ORDER NO

Customer

1-D

OPERATION							DEPT.	OPERATION							DEPT	OPERATION							DEPT	OPERATION							DEPT.
DATE	HRS.	LABOR	LABOR BURDEN	MACHINE NO	HRS	OP	Burden	DATE	HRS.	LABOR	LABOR BURDEN	MACHINE NO	HRS	OP	Burden	DATE	HRS.	LABOR	LABOR BURDEN	MACHINE NO	HRS	OP	Burden	DATE	HRS.	LABOR	LABOR BURDEN	MACHINE NO	HRS	OP	Burden

OPERATION							DEPT	MATERIAL COST				SUMMARY OF COST					
DATE	HRS.	LABOR	LABOR BURDEN	MACHINE NO	HRS	OP	Burden	REQ'N	DESCRIPTION	COST	BURDEN	LABOR	LABOR BURDEN	MACHINE BURDEN	OPERATION	TOTAL	UNIT
															Total Labor and Burden		
															Material		
															Material Burden		
															Total Manufacturing Cost		
															Crating		
															Outside Expense		
															Net Cost Complete		

Form 46: Job cost record.

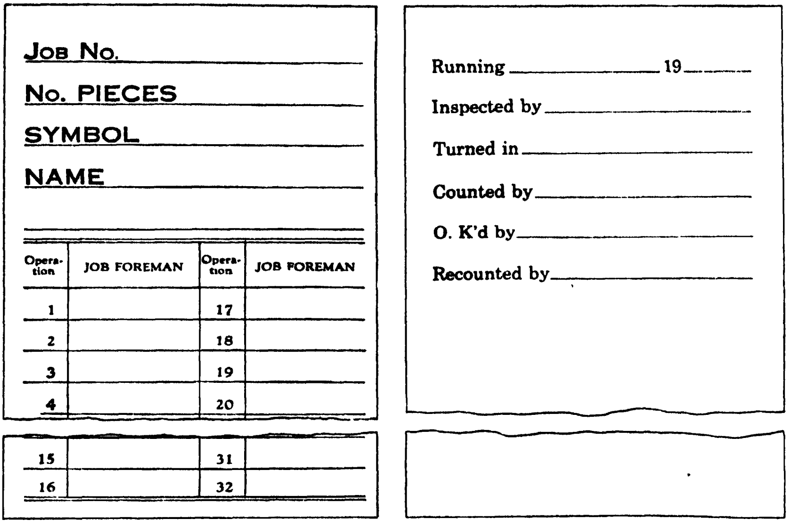
It will be seen first that several main columns are provided for the operation costs in the different departments; these main columns are subdivided into columns showing the Labor, Labor Burden, and Machine Burden for each department. This means that wages will be entered first, from the men's labor cards; then, in those departments where burden is added on a labor basis, the Labor Burden column is filled in with a figure equal to the number of labor hours multiplied by the labor burden rate. Where, on the other hand, burden is added on a machine basis, the third column will be filled in with an amount obtained by multiplying the number of machine hours operated by the machine-hour burden rate.

In the lower half of the form columns are given for Material Cost, in which will be written the quantities and values of materials used on this particular job. It will be seen that there is a Burden column here also, showing that this company uses a material burden rate, representing the cost of handling materials. Probably this is figured as a percentage of materials used; that is, if materials handled during a year total $1,200,000 in value, and the costs of handling them amount to $60,000, then on each cost sheet 5 per cent will be added to the cost of materials used. Finally in the right side of the lower half are spaces to summarize all the costs.

Job Order Form

It will still further illustrate the nature of the job cost sheet if we here consider the order which gives rise to it. Form 47 is such a job order. This form is not used in the same plant as Form 46, but the idea is very similar in both cases; that is, there would be an order something like Form 47 for every cost sheet like Form 46.

Form 47 is so simple because there are standard specifications already prepared and on file in the various departments. When therefore a given quantity of a certain article is wanted, it is only necessary to issue a job order which says in effect. Please make so many pieces of article ___, the symbol for which is ___; refer to your standard instructions for these articles, and you will see in detail what to do. The order card then contains spaces to indicate when each operation in the making of that article has been finished, this being done by the foreman signing his name. Then on Form 46, as has been seen, spaces are provided to record the costs of each of these operations.



JOB NO. ____

No. PIECES ____

SYMBOL ____

NAME ____

Operation	JOB FOREMAN	Operation	JOB FOREMAN
1		17	
2		18	
3		19	
4		20	
15		31	
16		32	

Running ____ 19 ____

Inspected by ____

Turned in ____

Counted by ____

O. K'd by ____

Recounted by ____

Form 47: Job order front and back.

Production Order for Parts

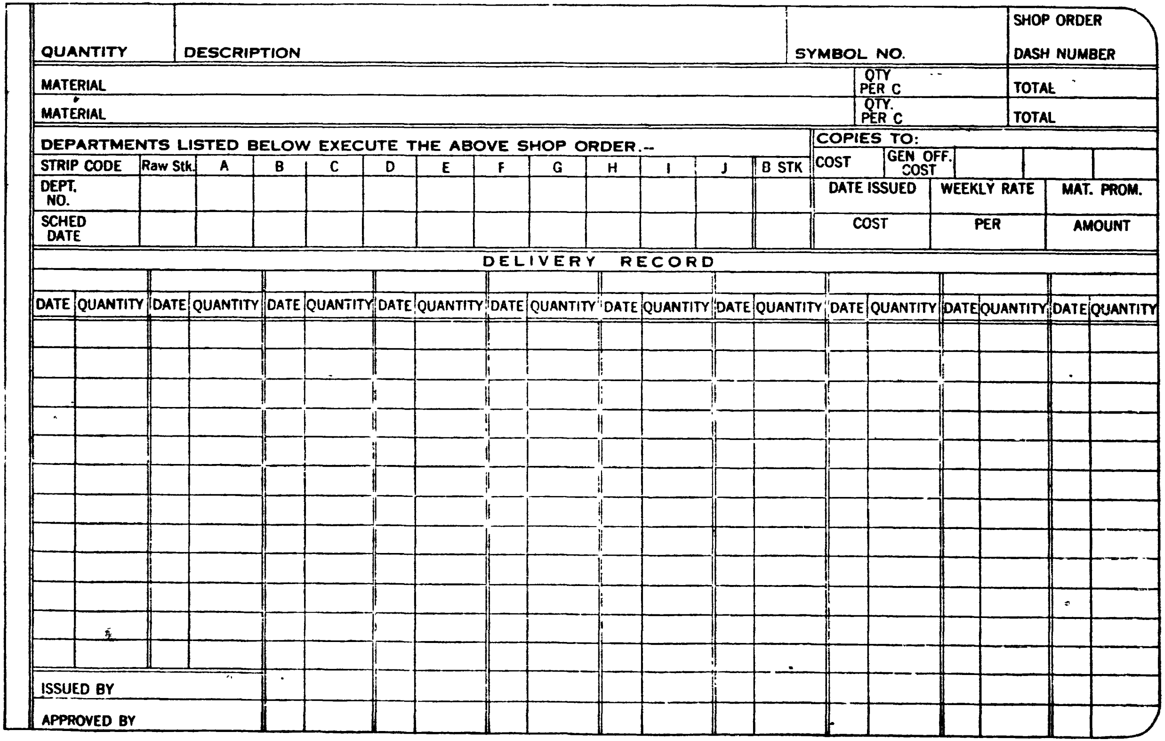
Form 48 is a somewhat more detailed production order; in addition to showing the departments which are to perform the operations, there are spaces in the lower part for recording deliveries from the various departments, as the parts progress through them. Thus the form serves as a route sheet; and when all the parts have completed the last operation, the cost department will close the cost sheet for this order and figure the cost per part, which is then noted on the production order.

Job Cost Sheet for Parts

Form 49 is a cost sheet used by a company making office machines. This particular cost sheet is used to record the costs of a specific order for a quantity of parts, on a production order like Form 48. It will be seen that the costs are gathered as materials, labor, and burden; these costs will later be shown in the inventory records (see Form 14) and from there carried to the costs of the finished machines when they are assembled.

Routing Instructions

Most of the forms so far shown relate to the manufacture and costing of standard parts, for which the operations have



QUANTITY	DESCRIPTION	SYMBOL NO.	SHOP ORDER DASH NUMBER
MATERIAL		QTY PER C	TOTAL
MATERIAL		QTY. PER C	TOTAL

DEPARTMENTS LISTED BELOW EXECUTE THE ABOVE SHOP ORDER.--

STRIP CODE	Raw Stk.	A	B	C	D	E	F	G	H	I	J	B STK
DEPT. NO.												
SCHED DATE												

COPIES TO:

COST	GEN OFF. COST			

DATE ISSUED	WEEKLY RATE	MAT. PROM.
COST	PER	AMOUNT

DELIVERY RECORD

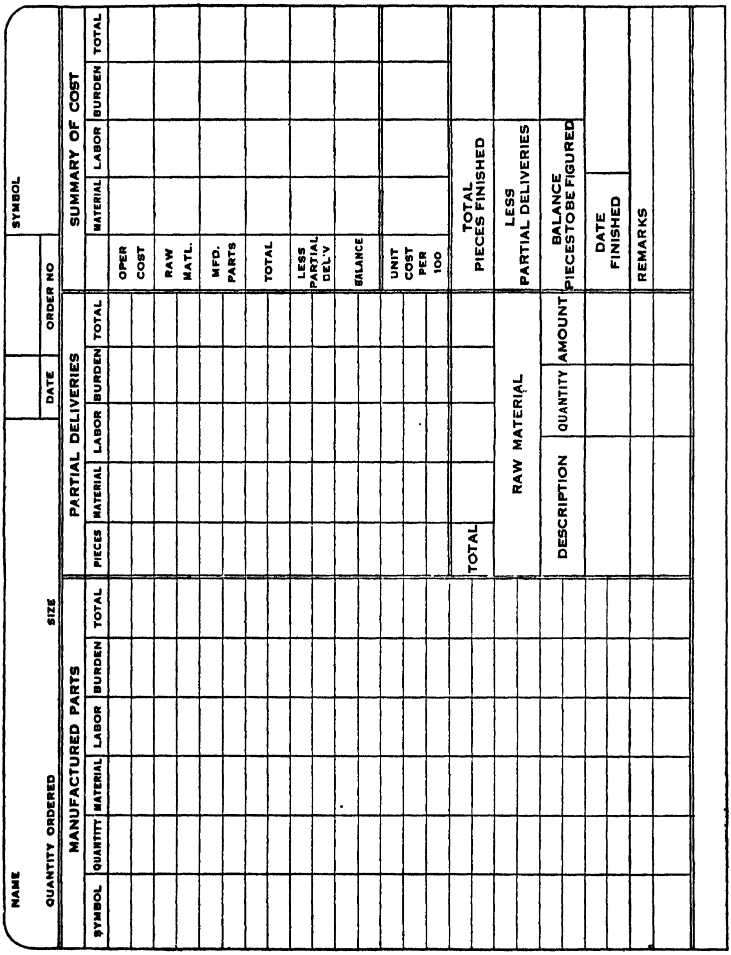
DATE	QUANTITY	DATE	QUANTITY	DATE	QUANTITY	DATE	QUANTITY	DATE	QUANTITY	DATE	QUANTITY	DATE	QUANTITY	DATE	QUANTITY	DATE	QUANTITY	DATE	QUANTITY

ISSUED BY

APPROVED BY

Form 48: Production order and record.

been fully described in standard drawings or instruction sheets. Form 50 is such a sheet; it shows the exact sequence of operations in the manufacture of a standard part, with the description of the operations and any special instructions which may be needed on them. The standard time allowed per 100 pieces is also shown, so that this form might be used in connection with a system of standard costs. At any rate it would be possible to compare the actual time taken with the standard time for the operations. Such a sheet is made out for practically every production order on which machining operations



NAME			SYMBOL
QUANTITY ORDERED	SIZE	DATE	ORDER NO

MANUFACTURED PARTS

SYMBOL	QUANTITY	MATERIAL	LABOR	BURDEN	TOTAL

PARTIAL DELIVERIES

PIECES	MATERIAL	LABOR	BURDEN	TOTAL

SUMMARY OF COST

	MATERIAL	LABOR	BURDEN	TOTAL
OPER COST				
RAW MATL.				
MFD. PARTS				
TOTAL				
LESS PARTIAL DEL'V				
BALANCE				
UNIT COST PER 100				

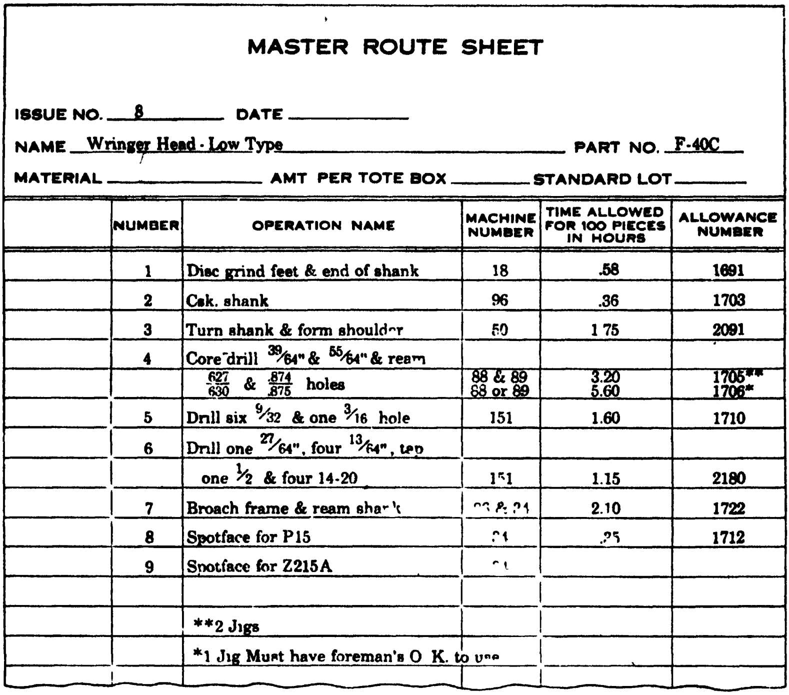
TOTAL PIECES FINISHED	LESS PARTIAL DELIVERIES	BALANCE PIECES TO BE FIGURED	DATE FINISHED	REMARKS

RAW MATERIAL

DESCRIPTION	QUANTITY	AMOUNT
TOTAL		

Form 49: Another form of job cost sheet.

need to be done. The time allowances would also be used as the basis for setting piece rates for the operators.



MASTER ROUTE SHEET

ISSUE NO. 8 DATE

NAME Wringer Head - Low Type PART NO. F-40C

MATERIAL AMT PER TOTE BOX STANDARD LOT

	NUMBER	OPERATION NAME	MACHINE NUMBER	TIME ALLOWED FOR 100 PIECES IN HOURS	ALLOWANCE NUMBER
	1	Disc grind feet & end of shank	18	.58	1691
	2	Csk. shank	96	.36	1703
	3	Turn shank & form shoulder	50	1 75	2091
	4	Core drill 39/64" & 55/64" & ream			
		$\frac{.627}{.630}$ & $\frac{.874}{.875}$ holes	88 & 89 88 or 89	3.20 5.60	1705** 1706*
	5	Drill six 9/32 & one 3/16 hole	151	1.60	1710
	6	Drill one 27/64", four 13/64", tap			
		one 1/2 & four 14-20	151	1.15	2180
	7	Broach frame & ream shank	23 & 24	2.10	1722
	8	Spotface for P15	24	.25	1712
	9	Spotface for Z215A	24		
		**2 Jigs			
		*1 Jig Must have foreman's O K. to use			

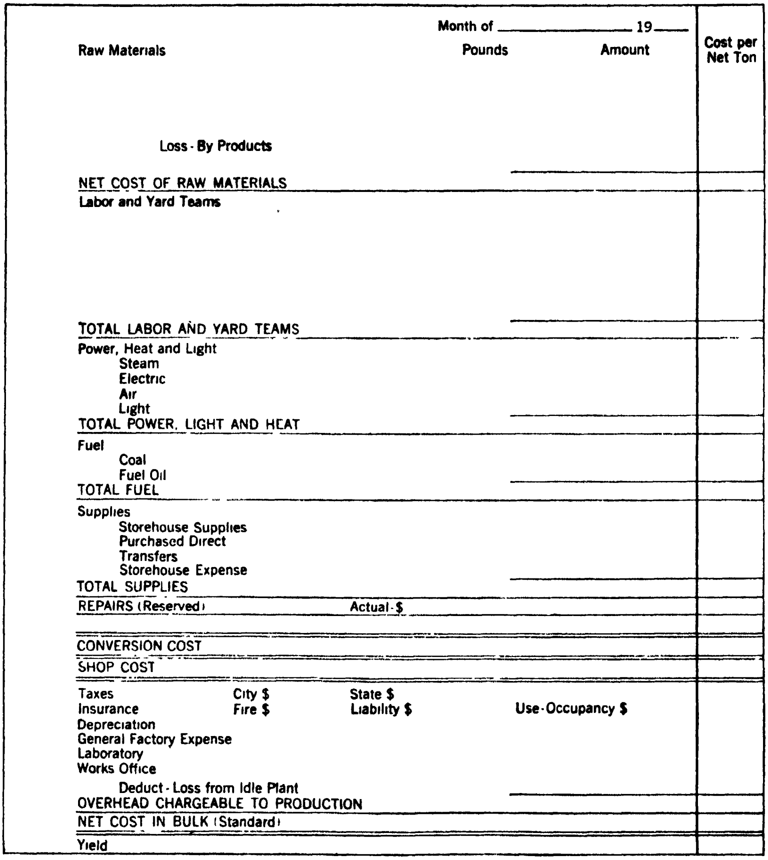
Form 50: Route sheet for a production order.

Process Cost Sheet

Under process costs the cost sheet takes the form of a monthly statement of expenses for each department; one department may complete one product, or it may represent only one process in the manufacture of that product. In either case the cost sheet will accumulate the total monthly expense of that product or process; by dividing the total units of output into the total cost, a cost per unit is obtained which may be compared with the cost per unit of the same product for other periods. Form 51 is a process cost sheet, as used in a chemical plant. The month covered is given at the head of the sheet, and all figures are for that month.

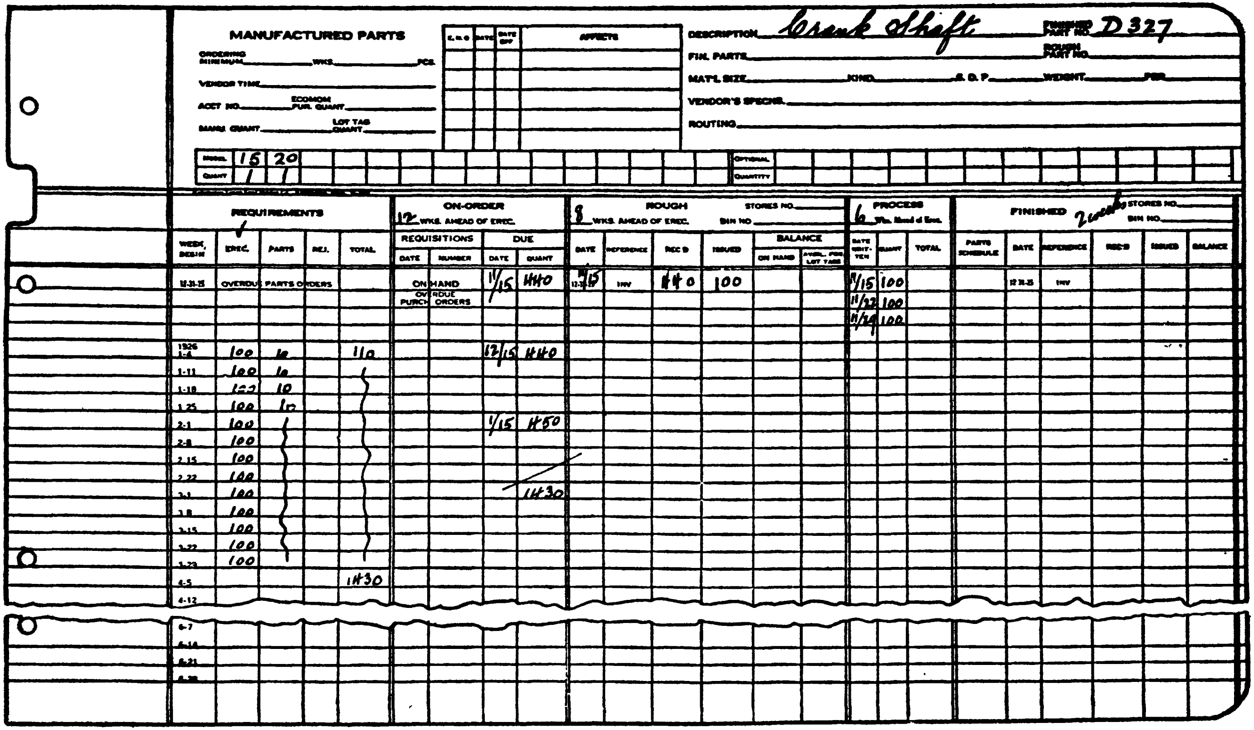
Operation Costs

In some cases, where operations consist of manufacturing a series of parts which are afterwards to be assembled into the finished product, it may be desirable to keep a record of the costs of the different operations. The main cost record will then be in card index form, with one card for each operation. Whenever that operation is performed, the date, quantity, and cost will be entered on the proper card, which will thus accumulate the costs of that operation upon the various occasions when it has been performed. Whenever the cost of any one lot is out of line, it may be taken up immediately with the foreman, who will investigate. By averaging the various costs, a standard cost for that operation may be set; these operation costs include both labor and burden. The cost of any one part may thus be built up of the cost of the



			Month of ______ 19__		
Raw Materials			Pounds	Amount	Cost per Net Ton
Loss - By Products					
NET COST OF RAW MATERIALS					
Labor and Yard Teams					
TOTAL LABOR AND YARD TEAMS					
Power, Heat and Light Steam Electric Air Light					
TOTAL POWER, LIGHT AND HEAT					
Fuel Coal Fuel Oil					
TOTAL FUEL					
Supplies Storehouse Supplies Purchased Direct Transfers Storehouse Expense					
TOTAL SUPPLIES					
REPAIRS (Reserved)		Actual-$			
CONVERSION COST					
SHOP COST					
Taxes	City $	State $			
Insurance	Fire $	Liability $	Use-Occupancy $		
Depreciation General Factory Expense Laboratory Works Office Deduct - Loss from Idle Plant					
OVERHEAD CHARGEABLE TO PRODUCTION					
NET COST IN BULK (Standard)					
Yield					

Form 51: Process cost record.



MANUFACTURED PARTS

ORDERING MINIMUM ______ WKS. ______ PCS.
VENDOR TIME ______
ACCT NO. ______ ECONOM PUR. QUANT. ______
MANU. QUANT. ______ LOT TAG QUANT. ______

E. R. O.	DATE	DATE OFF	AFFECTS

DESCRIPTION Crank Shaft FINISHED PART NO. D 327
FIN. PARTS ______ ROUGH PART NO. ______
MAT'L SIZE ______ KIND ______ S. D. P. ______ WEIGHT ______ PER ______
VENDOR'S SPECNS. ______
ROUTING ______

MODEL	15	20
QUANT	1	1

OPTIONAL QUANTITY

REQUIREMENTS ✓

ON-ORDER 12 WKS. AHEAD OF EREC.

ROUGH 8 WKS. AHEAD OF EREC. STORES NO. ______ BIN NO. ______

PROCESS 6 Wks. Ahead of Erec.

FINISHED 2 weeks STORES NO. ______ BIN NO. ______

WEEK, BEGIN	EREC.	PARTS	REJ.	TOTAL	REQUISITIONS DATE	REQUISITIONS NUMBER	DUE DATE	DUE QUANT	ROUGH DATE	REFERENCE	REC'D	ISSUED	BALANCE ON HAND	BALANCE AVAIL. FOR LOT TAGS	PROCESS DATE WRIT-TEN	QUANT	TOTAL	PARTS SCHEDULE	FINISHED DATE	REFERENCE	REC'D	ISSUED	BALANCE
12-31-25	OVERDUE PARTS ORDERS				ON HAND		11/15	1440	12-31-25 11/15	INV	1440	100			11/15	100			12-31-25	INV			
					OVERDUE PURCH ORDERS										11/22	100							
															11/29	100							
1926 1-4	100	10		110			12/15	1440															
1-11	100	10																					
1-18	100	10																					
1-25	100	10																					
2-1	100						1/15	1450															
2-8	100																						
2-15	100																						
2-22	100																						
3-1	100							1430															
3-8	100																						
3-15	100																						
3-22	100																						
3-29	100																						
4-5				1430																			
4-12																							
6-7																							
6-14																							
6-21																							
6-28																							

Form 52: Schedule of manufactured parts.

material in it plus the cost of every operation performed on it. The cost of the entire product is the sum of the costs of the various parts plus the labor and burden costs of assembling them.

This type of costing is characteristic of the automobile and truck industries, in the manufacture of parts. The system is combined with the scheduling and routing of parts, which are timed to arrive at finished stores as and when they will be needed for assembly into completed cars and trucks. Form 52 shows how such parts may be scheduled through successive departments, to conform with a master schedule for production of cars.

Test Runs in Costs

The question has been discussed as to whether a manufacturer should keep continuous costs, covering every lot and part of the product, or whether he may not reduce labor and simplify the records by keeping occasional trial costs of representative lots of the product. If the latter procedure can be followed with assurance that the figures so obtained are really representative, and that current conditions cannot depart from these figures without the change becoming apparent, then the work of the cost department will be greatly reduced and the number of reports which the management needs to scrutinize much fewer.

Consider the situation of a manufacturer of a number of lines, each one standardized, and many of them not running into very large volume; a candy manufacturer or a manufacturer of crackers and small cakes will serve as example. To keep continuous costs, with detailed figures covering each individual lot or batch, would involve an amount of clerical work wholly disproportionate to the value of the products—disproportionate also to the value of the information thus obtained. When, therefore, a particular kind of candy or cracker is first developed, the first few lots may be very carefully costed, and the results made to serve as a basis for determining selling prices. The cost figures thus obtained may also determine whether or not that particular line shall be marketed; the management will know from its previous experience at about how much they can sell such a product; they will probably have in mind a gross mark-up, or margin between manufacturing cost and selling price, below which they will refuse to go. If, therefore, the trial costs give a total which, when subtracted from the estimated selling price, will not give the desired margin of gross profit, the management will probably decide to drop that line or to modify it in such a way as to reduce the costs or to increase its attractiveness so that a higher selling price can be obtained for it.

Lots Specially Manufactured

If a few test runs of the product itself are made as a manufacturing experiment, it is obviously desirable that costs shall be kept of these tests as a guide in determining that the product is practicable from a manufacturing standpoint and its probable profitableness. When, however, that product is put into regular manufacture, costs should be kept of several of the early lots in order to be sure that they coincide with the figures previously obtained on the test runs of the product. It sometimes happens that products put through in the regular course do not incur the same costs as the same product manufactured under semi-laboratory conditions.

When costs have been taken on lots put through on the regular manufacturing schedule, the resulting figures may very appropriately be used as standards with which to compare subsequent figures. This does not mean that each subsequent lot need be recorded separately and in detail by the cost department; it means that, for example, the total monthly figures for the quantity manufactured should be comparable with the figures set up as standards.

Advantages of Quantity Production

As a matter of practice the figures relating to full-time operation ought always to show very considerable savings in costs as compared with part-time or experimental operation. This relates not so much to the proportionate savings brought about by spreading an amount of fixed charges over more units of product; this is important but is discussed elsewhere. What is referred to here is the fact that full-time operation for considerable periods, especially when it includes long runs of the same product, permits operatives to work out many tricks and short cuts which can be utilized profitably in later operation. With only part-time operation and short runs, there is not the same inducement or opportunity to devise these improved methods; and even if improvements are discovered, the run is over before there is much chance to apply them. The gains made under favorable long-run conditions, as compared with the cost figures for short runs, should not therefore be too readily accepted as satisfactory performance; such gains should be expected, and as far as possible the standards should be set not exactly to coincide with trial run figures but to reflect good performance for long runs, if long runs are expected.

It is often possible to effect simultaneously the double purpose of getting sample costs and sample merchandise. In the textile industry, for instance, it is necessary to provide samples of new cloths for salesmen to exhibit, as well as to make sure that patterns made by the designers will work out. These manufacturing runs, undertaken to provide samples of the goods, will be utilized also to make a computation of the costs. The same sort of situation often exists in the shoe industry.

Procedure for Costing Test Runs

In developing these new textile designs, the cost gathering will, of course, follow the lines of job cost methods. Materials will be put in either at current market price or at an average of what the cost prices of the materials are expected to be during the vogue of that particular pattern. Opportunity will be taken to make time studies of the labor operations and to determine piece rates or a bonus schedule from them, as is the common practice in the textile industry. The usual overhead rates of the department will be applied to complete the costs. It is then clear that the actual costs of subsequent lots, made under conditions of quantity production, can diverge from the costs of the trial run only under a limited number of conditions. Material costs can vary only because market prices have varied, or else because the quantity used has differed from the quantity specified as a result of experience in the trial run; both of these points should permit of observation and record. Labor costs will vary only if it is found necessary to change the piece rates, while burden rates will vary only with a revision of the general burden situation, as a result of changed expenses or a change in volume of production.

Examples of Use of Trial Costs

Trial costs of the sort discussed in this chapter are used in some of the greatest and most highly organized industries of the country. In the automobile industry[1] the parts are turned out in vast quantities, sometimes by men working in groups on a group piece rate or group bonus system. Careful figures are kept to check up the time taken on various parts from day to day, as compared with standard times previously set. As long as these standard times are maintained, there can be very little variation in the manufacturing costs; while if the cost of material itself varies, that change may easily be computed from market prices. In this situation a sample lot may be costed to get a cost figure whenever it is necessary. But continuous recording of costs on every lot is quite unnecessary.

Another use of trial costs occurs when a company is intending to purchase outside articles which it perhaps could make itself. The company will find it expedient to run one or two sample lots, keeping costs for them, and to use the resulting figures as a check upon quotations received for the same article from other manufacturers.

Estimated Costs in a Biscuit Bakery

This practice of costing occasional lots of standardized products has been used successfully by a biscuit manufacturer, who called it a system of "estimated costs." For each type of biscuit made, an estimated cost was set up in advance and the selling price based on this estimate. Afterwards continuous costs on all products were not kept, but once in every month each of the principal types of product was costed for a half day's run. The cost sheet showed the actual material, the actual labor, and the burden at standard rates for the actual time taken. In this case the burden was expressed as an "oven-hour rate" which was really a type of machine-hour rate. The sheet was, therefore, in effect a job cost sheet for the particular quantity in the batch run on the half day selected. It was also compared with the costs previously estimated. The purpose of the sample costs in this case was both to serve as a check on efficiency in manufacturing and also to compare the results with the original estimates. The costs of this company were not tied in with the financial accounts, and the management felt that these occasional test checks, of which a number were conducted every month, were a sufficient control over costs.

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[1] See articles relating to Packard Motor Car Company in *Factory, the Magazine of Management*, October, 1924, p. 495, November, 1924, p. 650, and December, 1924, p. 794.

"Tying-in" the Costs

Shall the work of the cost department be closely connected with that of the financial accounting department? Shall the figures produced by the cost department be checked against those of the accounting department? These questions do not always find the same answer in practice. In principle, everybody believes that the cost figures should agree with the corresponding financial figures, but there is difference of opinion as to how and how far this agreement ought to be carried in the records themselves.

Where the factory officers are chiefly engineers and approach the subject of costs from the engineering viewpoint of wanting a current check upon physical operations (a very desirable thing), there is sometimes an absence of sympathy, even opposition, to that checking and balancing process upon which accountants like to rely for the accuracy of their work. How far is it desirable that the works accountants should comply with the wishes of the general accounting authorities, even when the factory officers have no particular use for the records thus provided?

Reasons for Tying-in

The main point is, of course, that cost records which are not properly checked against the financial books will have a constant tendency to get more and more off base; when the various analyses and distributions have been made, the resulting figures will be found to have departed from the actual disbursements made by the treasurer. This situation will usually arise to some extent whether the cost figures are tied in with the financial accounting or not; one of the main objects of the whole procedure should be to bring out these differences and the reasons for them, and this cannot be done without connecting the two sets of records quite closely together.

The Federal Reserve Board, in its tentative proposal entitled "Uniform Accounting," submitted to the banking, manufacturing, and accounting world, has the following to say on this subject:

> When the cost system of a company does not form a part of the financial accounting scheme there is always a chance that orders might be completed and billed, but not taken out of the work in progress records. Especially is this the case when reliance is placed on such records to the extent that a physical inventory is not taken at the end of the period to verify the information shown therein. In these cases the sales for the month preceding the close of the fiscal period should be carefully compared with the orders in progress as shown by the inventory, to see that nothing that has been shipped is included in the inventory in error. Cost systems which are not coordinated with the financial accounts are unreliable and frequently misleading. Special attention should be called to every case in which the cost system is not adequately checked by the results of the financial accounting.

This statement has had a wide circulation and is generally regarded as an authoritative pronouncement on the subject.

As already suggested, the works manager sometimes objects to the undertaking of extra work by the cost clerks for the purpose of supporting what he regards as a purely mechanical and arbitrary device of the accountant. Every accountant of experience has, however, time after time seen himself safeguarded from serious error by this balancing process; the more complex the records, the more desirable does it become to apply the self-checking and self-balancing process to them. Just as the engineer has his own method of checking and measuring to assure himself that all is well, so the accountant will rely on his double-entry checks for the same purpose. It is, therefore, not too much to expect that the works staff should cooperate with the accounting department to get these results. Where the cost reports are to be made to the treasurer or comptroller, he will often insist that this tying-in be done.

It should be recognized that the ledger inventory accounts for raw materials, work in process, and finished goods are involved in this question. Without the tie-in there can scarcely be a continuous accounting record of these inventories, which are essential if any worth-while monthly statements are to be prepared.

Procedure for Tying-in

It is not necessary that a great amount of work be done to accomplish this purpose. Essentially all that is necessary is that the various activities of the works, as shown in detail in the cost records, be summarized into monthly totals, which totals may be entered in the general accounts. All new materials purchased will, of course, be entered in total in the general books as well as in detail in the factory records; when these goods are withdrawn from stores and put into process on requisitions, the details will again be recorded in the factory records, but the summaries should also be included in the general records at the end of the month. The same procedure is necessary with the distribution of the payroll and of general expenses, the latter coming from a standard journal entry for burden distribution.

The next step will be to prepare a summary of work completed during the period. This summary is sometimes made in connection with the sales record, if jobs are billed to customers immediately upon completion; otherwise a summary of jobs completed and put into stock may be made, the total of which will be a credit to Work in Process and a debit to Finished Goods.

As a matter of fact, it is essential that this summarizing be done in order to get the necessary monthly cost reports. It is but a step further to have the summarizing done in a form which will permit of the results being incorporated in the general financial books. There are, of course, many bookkeepers who are not competent to carry out this procedure; but when the process is once learned, it can often be carried on with no increase whatever in the volume of work or in the amount of time which needs to be taken.

Procedure for Tying-in Illustrated

The process of tying in the costs should be made clear. In ordinary financial accounting debits are made to accounts representing materials, labor, and manufacturing expenses whenever expenditures are made for those items. If there is no tying-in, these debits simply remain in the accounts to which they are charged until the end of the accounting period, when their entire balances are closed into some clearing account; at the same time inventories are taken to complete the clearing account and to find out the cost of goods sold. There may be cost figures outside the books, summarizing the costs of goods manufactured; usually these will be in the form of summaries of the job or monthly cost sheets; but so far these figures have not been entered in the books of account or matched directly against the original debits for expenditures. These total outside figures should then represent the cost of goods made and transferred from the factory to the finished goods warehouse; to record them in the ledger their total value is credited in Work in Process account and debited in Finished Goods account. Since the debits in Work in Process represent the actual expenditures, transferred there from their original accounts, these actual original costs are in that account matched against the computed costs as summarized from cost sheets, and the tying-in process is complete. The following diagram of the Work in Process account will explain this:

WORK IN PROCESS

Debits for:	Credits for:
1. Opening Inventory 2. Materials Used, Labor, and Burden, as transferred from their respective accounts	1. Total costs of goods completed and transferred to finished goods warehouse. These cost figures are taken from the cost sheets or other summaries of cost figures 2. Closing Inventory of work still in process

When all these items have been entered, the account should balance, and the tie-in is complete and perfect. If it does not balance, there must either be some differences due to using standard costs on the credit side, these differences being of the kind discussed in Chapter XXI, or else the basis of summarizing the costs, as reflected on the credit side, is wrong. It is the object of the tying-in to reveal such differences and errors as these.

A Modified Tie-in

It is understood that an effective check between the cost and financial records may in some cases be made without making actual transfers upon the books for that purpose. In such cases it is permissible to omit the transferring entries. Often it will pay to make the complete tie-in for a period, say, of one or two years, in order to be sure that the situation is well in hand. If, as a result, no serious discrepancies appear, it may be permissible to discontinue the tying-in process for as long as no important changes in organization or expenses take place.

Practically all the larger firms do, in fact, summarize their cost records and enter them in the financial books for the purpose of effecting a union between the two which will serve as a check upon both and furnish inventory figures for the statements. If the books are well planned, the work involved in this tie-in is not great, and the check resulting is of considerable advantage.

Relative Importance of Material, Labor and Burden

It is of interest to observe the widely varying proportions which the three main elements in costs bear to the total costs in different industries; the following table, showing a representative sampling of leading industries, brings this fact out very clearly. Still more extreme cases could be shown, where delicate products are made by intricate manufacturing processes in which labor and burden can amount to a large proportion of the total cost. Even so, the table gives labor as varying from 3 per cent for flour milling to 46 per cent for watches, while burden varies from 9 per cent in meat packing to 38 per cent in electrical equipment and 44 per cent in airplane manufacture. The average figures cannot be said to represent any one industry, but they show that, for industry as a whole, raw materials constitute more than half the manufacturing costs, and burden is substantially in excess of direct labor.

But these proportions represent only a group of manufacturing companies; the average proportions here given cannot be said to represent society as a whole, because the materials which come to these companies have already been processed to some extent. Labor and burden, in some cases a good deal of it, have already been added to the original raw materials that were extracted from the earth. To the individual company the term "raw materials" means "materials which have not been processed in any way by our company." But if the following list of companies be considered, it will be seen that in practically all of them some labor has been expended on the materials they receive. Even with meat packing and flour milling, the raw materials include the labor of the farmer in raising the live animals and wheat, to say nothing of the labor of transportation; while in cases like automobile manufacture, machine tools, or watches, it is probable that there is as much labor already in the raw materials as will be added to them by these industries.

RELATIVE IMPORTANCE OF MATERIAL, LABOR, AND BURDEN

Industries	Percentage of total manufacturing cost		
	Material	Direct labor	Burden
Meat packing	86	5	9
Flour milling	87	3	10
Bakeries	53	17	30
Cotton goods	63	21	16
Woolen goods	61	23	16
Men's clothing	51	19	30
Steel plants—rolling mills	62	21	17
Machine tools	31	32	37
Automobiles	70	10	20
Electrical equipment	41	21	38
Watches	17	46	37
Fountain pens	55	18	27
Furniture	44	26	30
Leather boots and shoes	52	24	24
Rubber boots and shoes	60	30	10
Calf leather tanning	72	16	12
Airplanes	23	33	44
Alum	52	8	40
Averages	55	21	25

NOTE: Most of the foregoing figures have been computed from the tables relating to *Manufactures; Summary for Individual Industries, in the Statistical Abstract for the United States*, 1928. The others are from the figures of individual plants.

Cost Estimates for Bidding

Wherever a company is making goods or doing contract work to special order, it is nearly always the practice to submit a bid, offering to supply the goods or do the work at a specified price. This price is, or ought to be, based upon very careful estimates of the cost of the work. The business will have an estimate sheet on which to assemble the data; this estimate sheet looks very much like a job cost sheet but contains estimated costs of the product before doing the work, whereas the job cost sheet normally contains the actual cost of the product after doing the work.

The preparation of these estimates is one of the most important duties of the cost department; in fact a separate division of that department is often set up to handle this work. The estimates will start from accurate and detailed specifications, together with engineering or architects' drawings. From these the required quantities of the various materials are estimated and also the hours of labor or labor costs stated in terms of per unit of work. Any other costs for special equipment or special tools will similarly be charged to the estimate, and overhead will be added at the established rates. But these rates also will be applied probably on an hourly basis and will, therefore, depend for their accuracy on correct estimates of the amount of work to be done.

In general, therefore, three things are necessary to the success of the work of the estimating department. First, they must have accurate specifications and drawings of the buildings or machinery to be constructed; second, they must have the technical skill to convert these drawings into the quantities of materials and labor which it will take to complete the work; third, they must have accurate material costs from current price lists, and accurate labor unit costs derived from their past experience. When the aggregate estimated cost has been arrived at, the management must use its discretion in adding the amount of profit they think the job should carry, and the result will give them the price they should quote for the work.

QUESTIONS AND PROBLEMS

1. What would probably be the main plan of computing costs (*a*) in a plant making rubber tires, (*b*) in a plant making boots and shoes, (*c*) in a plant making large machines to customers' orders? In each case state your reasons, giving very briefly the outline of the cost-gathering process as you see it.

2. The following are the facts regarding Order 61854 in the MacPhail Printing Company. The job was to print 1,000 copies of a catalogue for the Johnson Furniture Company, according to copy submitted.

The job included 6.2 hr. of hand composition at $2.55 per hour; it required also 6.3 hr. of machine composition on the linotype at $3.50 per hour. When the type had thus been set, it was necessary to run it 5.1 hr.

on a medium-sized cylinder press at $3.50 per hour, and, in addition, for 3.6 hr. on a smaller cylinder press at $3.00 per hour.

NOTE: As a matter of convenience, in computing the amounts of these charges, the nearest 5¢ above the exact figure is used.

The materials used on the job were 800 sheets of coated Vienna stock, being 160 lb. at 14¢ per pound; 2 lb. of special ink at 75¢. The bindery materials cost $7.10.

a. Design a form suitable for gathering job costs of this sort, and enter the foregoing information on the form to find the total cost.

b. Explain the meaning of the foregoing hourly rates for hand composition, machine composition, and cylinder presses; what is included in these rates?

c. How is direct labor treated in the foregoing statement of costs, and what is the reason for that method of treatment?

3. What is meant by the cost of a test run? Under what circumstances will such costs be sought? In what form will such costs be gathered? What is your opinion of the practice?

4. In your opinion, is it desirable or necessary that cost records of a company should be tied in with its financial records? What is meant by tying in the cost records, and what is the purpose of doing it?

5. In the ledger of a manufacturing company the following accounts appeared; when the trial balance was prepared on December 31, 1928, the debit balances were as shown:

Raw Materials, Metal	$ 37,500
Other	31,900
Work in Process, Materials	20,860
Foundry Labor and Burden	13,770
Machine Shop Labor and Burden	14,590
Finishing Labor and Burden	12,850
Cost of Goods Sold	236,890

The company manufactured goods to customers' orders. At the time the foregoing trial balance was prepared, the monthly transfers necessary to tie in the cost records with the ledger accounts had been prepared and recorded.

a. At this stage what does each of the foregoing balances represent?

b. Describe the records which would be necessary in this case to tie in the cost records with the ledger accounts. What postings would be made from these records to the accounts to accomplish this tie in?

6. Is it essential in all cases to keep detailed records of the cost of each individual lot of every product? Explain your answer by giving examples of industries where you think this should or should not be done?

7. Cost systems, in general, may be divided into two groups:[1]

a. Those in which costs are obtained by jobs, products or classes of products and

b. Those in which costs are obtained for operations and processes.

Describe the salient characteristics of and principal points of difference between the two groups of systems and show how unit costs are attained in each.

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[1] American Institute of Accountants, May, 1925.

Indicate which system is most suitable for the following classes of businesses noting particularly where one system may be desirable in one department and a different method applicable in another:

1. Manufacture of metal novelties.
2. Foundry.
3. Machine shop.
4. Coal mining.
5. Steamship line.
6. Stone quarry.
7. Manufacture of standard sizes of iron pipe.
8. Brick making.
9. Pneumatic tire making.
10. Manufacture of fertilizer.

8. The Pacific Logging Company completed its first year of logging operations on December 31, 1926. A list of balances from the company's ledger (before closing) at December 31, 1926, was as follows:

Capital stock			$4,200,000
First mortgage 7% bonds			700,000
Timber		$4,000,600	
Booming ground		9,000	
Main railroad	$309,641		
Subsidiary railroad	235,000		
		544,641	
Logging engines, machinery and camp equipment		703,000	
Cash in bank and on hand		23,250	
Notes and accounts receivable		113,700	
Notes and accounts payable			40,737
Furniture and fixtures—city office		2,137	
Unexpired insurance premiums		4,134	
Reserve—depreciation			72,210
Wages accrued			23,780
Property taxes accrued			59,575
Labor and expenses:			
Felling and sawing	$ 96,075		
Yarding and loading	102,460		
Scalers	8,837		
Rigging	33,273		
Hauling	135,040		
Booming and rafting	13,577		
		389,262	
Sales			974,500
Maintenance—railroads	$ 32,015		
" —camp	4,710		
		36,725	
Depreciation—logging engines, machinery and camp equipment	$ 71,997		
Depreciation—city office furniture and fixtures	213		
		72,210	
Insurance—industrial	$ 13,403		
" —on equipment (fire)	8,075		
		21,478	

Property taxes		59,575	
Superintendence		11,970	
Administrative salaries		19,415	
Interest—on bonds	$ 49,000		
" —on notes payable	1,647		
		50,647	
Fire-patrol expense		4,733	
City office expense		4,325	
		$6,070,802	$6,070,802

In arriving at the results of its operations for the year 1926, the company's officers had not considered depletion of timber cut for the year nor the amount which should be charged to cost of operations in respect of amortization of railway construction.

The trustees for the bondholders require a statement of profit and loss for the year 1926, showing the average cost of logs cut and of logs sold, also a balance-sheet as at December 31, 1926.

The following information is obtained from the records of the company:

TOTAL STANDING TIMBER ACQUIRED AT INCEPTION OF COMPANY

	Feet	Cost per M feet	Total Cost
Yellow fir	700,450,000	$4.00	$2,801,800
Hemlock	300,200,000	1.20	360,240
Cedar	48,600,000	4.00	194,400
Spruce	113,915,000	4.00	455,660
Red fir	75,400,000	2.50	188,500
	1,238,565,000		$4,000,600

LOGS CUT DURING THE YEAR 1926

Yellow fir	51,000,000 feet
Hemlock	14,000,000 "
Cedar	1,800,000 "
Spruce	6,810,000 "
Red fir	2,250,000 "

LOGS SOLD DURING THE YEAR 1926

Yellow fir	45,400,000 ft.	@ $15.00 per M ft.
Hemlock	12,500,000 "	" 12.50 " " "
Cedar	1,800,000 "	" 15.00 " " "
Spruce	4,250,000 "	" 18.00 " " "
Red fir	2,250,000 "	" 15.00 " " "

There was used by the company for the construction of donkey sleds, during the year, 100,500 feet of yellow fir, which is included in the foregoing figures representing the timber cut during 1926. The cost of logs so used for construction purposes is to be added to capital expenditures at the average cost of production of all logs cut for the year, the construction labor cost thereon having been ascertained to be already included in the equipment account.

The inventory of logs "in pond" as scaled (i.e. ready for sale) at December 31, 1926, was as follows:

Yellow fir	5,499,500 feet
Hemlock	1,500,000 feet
Spruce	2,560,000 feet
	9,559,500 feet

The inventory is to be valued at the average cost of all logs cut during the year, no segregation of costs to be made on the various kinds of timber cut.

In addition to the logs cut, as above recorded, there were 500,000 feet of yellow fir logs and 500,000 feet of spruce logs lying in the woods, felled and sawed, and the cost of felling and sawing such logs is included as part of the operating expenses for the year 1926, on the company's books. These logs are to be valued at stumpage cost, plus felling and sawing cost only, as no other costs are applicable thereto.

The railway construction is described in the accounts as main railroad and subsidiary railroad. The main railroad is a completed unit and all the company's standing timber will have to be hauled over that road as cut. The subsidiary railroad is not a completed unit. When completed, the total cost is estimated to be $540,000. The standing timber to be hauled over the subsidiary railroad is 600,000,000 feet. When the timber is all cut both railroads are to be considered as being of no further use and to have no salvage value. Of the total timber cut for the year 1926, 40,000,000 feet were cut from the standing timber adjacent to, and hauled over, the subsidiary railroad.

Depreciation has been provided on all plant and equipment and is to be considered adequate.

An examination of the accounts receivable disclosed worthless accounts amounting to $5,500.

From the foregoing list of balances and supplementary information, prepare the statements desired by the trustees for the bondholders and submit details of the adjustments of accounts considered necessary by you, ignoring income-tax features.[1]

9. You are employed by the X Company, engaged in the manufacture of electric washing machines, to make an audit of its books of account and records for the year ended December 31, 1925.

From the following trial balance (abstracted from the company's books as of December 31, 1925, before closing) and accompanying data, prepare such adjusting entries as you think necessary; a balance-sheet as at January 1, 1926, and a detailed statement of income and profits for the year ended December 31, 1925.

Cash	$ 235,240	
Accounts receivable	547,000	
Notes receivable	36,250	
Land	150,000	
Buildings	450,000	
Machinery and equipment	1,000,000	
Tools	51,000	
Reserve for depreciation—Buildings		$ 131,000

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[1] American Institute of Accountants, November, 1927.

Reserve for depreciation—Machinery and equipment		310,000
" " " —Tools		27,500
Stationery and office supplies	12,620	
Salesmen's salaries	87,500	
Inventory—Work in process and finished goods, December 31, 1924	525,000	
" —Materials, December 31, 1924	350,000	
Reserve for bad debts	1,600	
Donations	350	
General office salaries	32,520	
Unexpired insurance	2,650	
Return sales and allowances	31,720	
Power, light and heat	37,650	
Maintenance and repairs	39,265	
Sundry factory expenses	37,875	
Factory supplies	73,060	
Direct labor	450,000	
Materials purchased	1,625,000	
Depreciation, buildings	6,000	
" machinery and equipment	60,000	
" tools	12,500	
Sales		3,340,000
Indirect labor	242,000	
Insurance	18,700	
Executive salaries	110,000	
Miscellaneous office expense	3,700	
Interest paid	8,400	
Bank loans		50,000
Trade accounts payable		81,000
Accrued wages		24,650
Property taxes	12,950	
Traveling expense, salesmen	14,820	
Advertising	18,000	
Capital stock, common—$100 par per share		1,000,000
" " preferred—7% cumulative, $100 par per share		350,000
Accrued local taxes		8,750
Surplus		973,970
Tools produced for company's use		11,000
Dividends paid	24,500	
	$6,307,870	$6,307,870

During the course of your audit, the following facts are disclosed:

The cashbook was held open at the close of the accounting period and collections on customers' accounts of $20,000, received in January, 1926, were included in the period under review as cash in transit.

The accounts receivable are found to be in bad condition and to include $12,000, admittedly worthless, and $17,000 on which only a fifty per cent recovery is expected. Of the bad accounts, $11,000 relate to prior years as do $8,000 of the doubtful accounts. All accounts written off by the company in 1925 relate to prior years. Notes receivable are considered to be good. Your examination of the bad debt reserve indicates a debit balance of $1,600, per books, as at December 31, 1925.

The inventories, December 31, 1925, consist of the following:

Raw materials	$380,000
Factory supplies	18,600
Work in process and finished goods	750,000

The work in process and finished goods inventories comprise the following elements of cost:

	1924	1925
Labor	$100,000	$140,000
Materials	300,000	400,000
Factory overhead	125,000	210,000

Overhead is distributed on the basis of productive labor and your examination of the cost accounts discloses the following:

	Actual Productive Labor	Actual Overhead	Rate Used in Cost System
1923	$400,000	$490,000	125%
1924	300,000	480,000	125
1925	450,000	540,000	150

The company computes its depreciation on the basis of rates applied to cost values at January 1, 1925, although effect has been given, on the books of the company, to an appraisal of all properties as of January 1, 1925.

Following is a summary of the property accounts and reserves for depreciation:

	Book Value Dec. 31, 1924 (Cost)	Appraisal Values Jan. 1, 1925
Gross value:		
Land	$ 50,000	$ 150,000
Buildings	300,000	450,000
Machinery and equipment	600,000	1,000,000
Tools	50,000	40,000
Reserves for depreciation:		
Buildings	150,000	125,000
Machinery and equipment	400,000	250,000
Tools	30,000	15,000

The following rates of depreciation used by the company are found adequate: buildings, 2 per cent; machinery and equipment, 10 per cent; tools, 25 per cent. Additions to the property accounts during 1925 consisted entirely of tools manufactured in the company's plant. These were not completed and ready for use until December 31, 1925. Charges to the tool account represent the following items: materials, $1,000; labor, $4,000; overhead, $6,000.

The company has made no provision for federal taxes for 1925 and admits that its liabilities are, in this respect, understated. It claims, however, that it has no federal tax liability for taxes for prior years. Upon examination of the company's returns and tax file, you find that although heavy losses, incurred in 1921 and 1922, would practically offset the profits of 1923 and 1924, the company made very large profits in 1918, 1919 and 1920; that a field agent has made an examination and found an additional tax liability for these years of $100,000. A letter in the files from the company's tax attorneys estimates the liability at $75,000 and your own scrutiny of the returns for these years serves to confirm this estimate.

Among the stipulations of the preferred stock agreement is a clause to the effect that annually, on or before March 31st of each year, the company shall set aside, out of the earnings of the calendar year preceding, the amount of $25,000 to purchase for retirement and cancellation an equivalent par amount of preferred stock which is callable by lot at par.[1]

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[1] American Institute of Accountants, November, 1926.

XVI

COSTING BY-PRODUCTS AND JOINT PRODUCTS

Problem of Joint Costs

One of the most troublesome problems of costing arises when two or more products emerge from the same process or series of processes. How shall the joint costs of the several products be apportioned among them? It may first be pointed out that it is not in all cases necessary to find a definite answer to this question; that is to say, in some cases no practical use could be made of the information even if a separate cost for each product could be definitely ascertained. If two products result from a certain process, the total cost of the two products is the total cost of the process, plus the cost of raw materials. The price policy of the business will aim to get the greatest possible combined return from the two, and to produce such a quantity of both products that each can be sold at a price which will give this greatest combined net return. This price policy, moreover, will be followed regardless of any apportionment of costs between the two products. Still further, when one product has a higher market value than the other, effort will always be made, as far as possible, to obtain a higher yield for the more valuable product and a lower yield for the less valuable. In these circumstances it is not uncommon for a manufacturer to leave his problem of joint costs unsolved, and to compute only the combined costs, which will be offset against the combined income.

Different Cases of Joint Costs

There are, nevertheless, many occasions when it is desirable and even necessary to make an apportionment of costs between the products. This is notably true when one or other of the products must after the separation be put through further manufacturing processes before it is ready for sale. A separate cost for the two products must then be found at the point where they divide, in order that the subsequent costs which apply to each may be added and a satisfactory final cost obtained.

Three different degrees of joint products may be discussed in this connection. The first is the treatment of waste and scrap; the second is the treatment of a by-product of small value compared with that of the main product; the third is the case of true joint costs, in the commercial sense, where each product has a substantial value.

Waste

The first case is illustrated by common waste in a textile mill or the scrap resulting from cutting out stampings from sheet metals. A certain amount of such waste is inevitable; the business of the management is first to purchase raw materials in such sizes and of such qualities as will help to reduce this waste to a minimum, and next to see that a like object is kept in mind in the manufacturing processes. For these purposes a physical weighing or measuring of the quantities of waste is usually practiced, and a record is kept which will indicate when these quantities get out of line. A standard allowance of waste is set for each department, expressed as a percentage of the volume of materials handled there; this makes a convenient basis with which to compare the actual quantities of waste. For management purposes that is all that can be done; it is common, therefore, in the costs, to record the entire income from the sale of scrap as a credit to the manufacturing account, thus leaving the balance of the costs to be loaded on to good production.

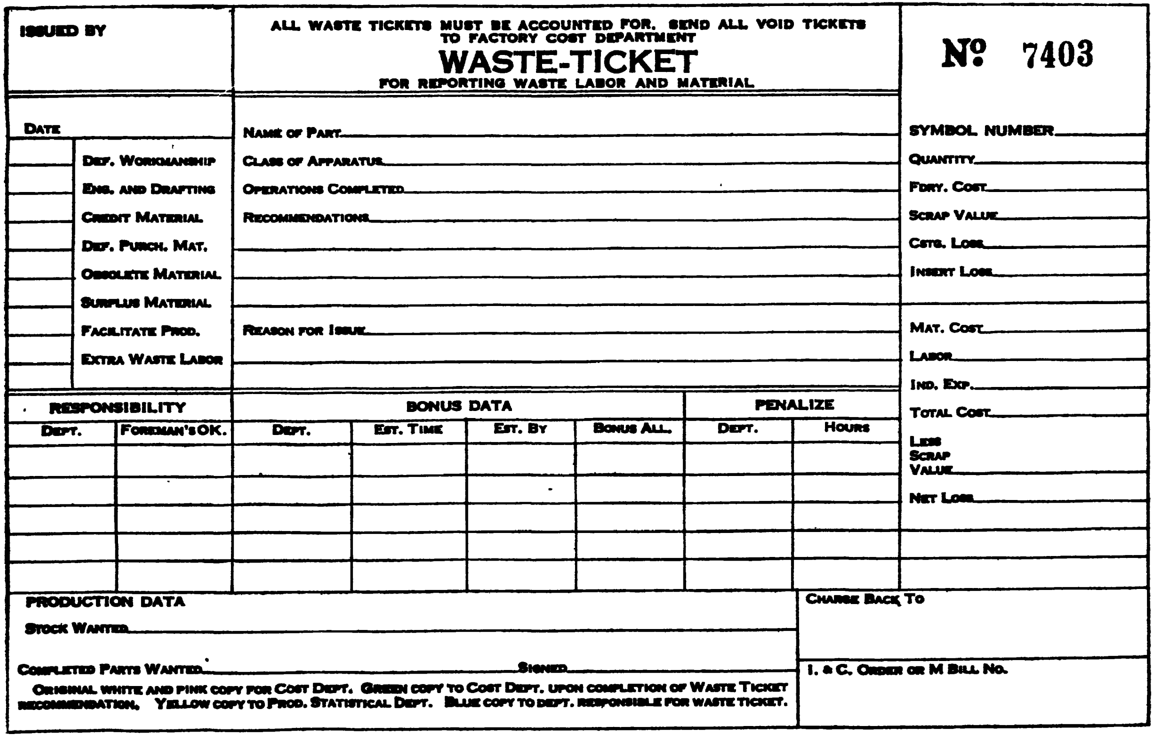
These records for waste may be illustrated by an example. If sales of waste are made, amounting to $1,500, the record in journal form is:

Cash (or Accounts Receivable)	$1500	
Income from Waste Sales		$1500

At the end of the year (or month) the latter account would be closed into Work in Process. If the total debits of Work in Process amounted to $754,000, the credit for waste sales would be a subtraction, leaving $752,500 as the net cost of goods manufactured.

Spoilage of Valuable Work

When the waste arises from defective work or defective materials in parts which have had work done on them and



ISSUED BY

ALL WASTE TICKETS MUST BE ACCOUNTED FOR. SEND ALL VOID TICKETS TO FACTORY COST DEPARTMENT

WASTE-TICKET

FOR REPORTING WASTE LABOR AND MATERIAL

No 7403

DATE

DEF. WORKMANSHIP

ENG. AND DRAFTING

CREDIT MATERIAL

DEF. PURCH. MAT.

OBSOLETE MATERIAL

SURPLUS MATERIAL

FACILITATE PROD.

EXTRA WASTE LABOR

NAME OF PART________

CLASS OF APPARATUS________

OPERATIONS COMPLETED________

RECOMMENDATIONS________

REASON FOR ISSUE________

SYMBOL NUMBER________

QUANTITY________

FDRY. COST________

SCRAP VALUE________

CSTG. LOSS________

INSERT LOSS________

MAT. COST________

LABOR________

IND. EXP.________

TOTAL COST________

LESS SCRAP VALUE________

NET LOSS________

RESPONSIBILITY		BONUS DATA				PENALIZE	
DEPT.	FOREMAN'S OK.	DEPT.	EST. TIME	EST. BY	BONUS ALL.	DEPT.	HOURS

PRODUCTION DATA

STOCK WANTED________

COMPLETED PARTS WANTED________ SIGNED________

ORIGINAL WHITE AND PINK COPY FOR COST DEPT. GREEN COPY TO COST DEPT. UPON COMPLETION OF WASTE TICKET RECOMMENDATION. YELLOW COPY TO PROD. STATISTICAL DEPT. BLUE COPY TO DEPT. RESPONSIBLE FOR WASTE TICKET.

CHARGE BACK TO

I. & C. ORDER OR M BILL NO.

Form 53: Waste ticket for spoiled work.

therefore amount to some appreciable value, a more elaborate accounting will be kept than is shown above. A waste ticket (Form 53) will be made, showing full particulars of the materials damaged, the stage they had reached when spoiled, and the causes of their being rejected. The cost value of the spoiled parts is computed, as well as the scrap value, and these will be used in a journal entry as follows:

Loss from Spoilage	29.40	
Scrap Metal Stores	5.50	
Work in Process		34.90

The Loss from Spoilage debit records the loss as the difference between the cost value and the salvage value at which the spoiled goods may be put into stores. The normal or average amount of loss from spoilage will be an element in the standard burden charge.

By-products

The by-product creates a somewhat different situation in that it is a new product, different from the materials which entered into it. One example of it is nitre cake produced in the process of making nitric acid, the cake being worth about 2 per cent of the value of the acid; in the manufacture of soap, soap-lye glycerine is produced to a value varying between 5 and 10 per cent of the value of the soap. When the secondary product is so relatively small in value as this, however, it is again common to credit it in the cost records at its selling price in the market, leaving the main product to bear all the other costs.

Joint Products

In the third case, both products being of substantial value, the management will inevitably seek to make a profit on each one. In order to determine that profit, separate cost figures become necessary. In the manufacture of muriatic acid, salt cake to a value approximating 80 per cent of the value of the acid is produced; in making veneer the logs which cannot be used for veneer are sold as lumber, the income from which may vary between 10 and 30 per cent of the income from the veneer; the division of the cocoa bean into cocoa powder and chocolate is another case where both products have substantial value. No definite line has been drawn to indicate when a by-product becomes a joint product, but it may be said that, whenever the value of the by-product exceeds 10 per cent of the value of the major product, the question may fairly be raised whether it is not desirable to find a separate cost for each.

A number of plans have been tried for apportioning costs of materials between the two products. If they are approximately equal in value per pound or per gallon, it is, of course, permissible to cost them equally at that point, with each such additional costs as properly apply added afterwards. This condition will, however, rarely be the case, and an arbitrary prorating then becomes inevitable. For this purpose three principal methods have been followed.

A Standard Cost for the Subproduct

One method is to use a standard price per pound for the less important product, which has the effect of letting all fluctuations in cost rest upon the more important product; presumably this standard cost will coincide approximately with the market value of the product at the time the standard is adopted. The obvious disadvantage of this method is that all subsequent fluctuations in the joint or total costs will put the figures out of line. If the selling price of the less valuable product should increase, it will show enhanced profits without any corresponding increase in cost; the cost of the principal product may, on the other hand, vary without any corresponding change in its selling price. A fictitious showing thus results.

This conclusion will be made clearer by consideration of a few cases of parallel figures, thus:

	Case 1	Case 2	Case 3
a. Value per pound of materials at point where subdivided.......	20¢	22¢	25¢
b. Pounds of materials processed...	2,000,000	2,000,000	2,000,000
c. Value of materials processed ($a \times b$)....................	$400,000	$440,000	$500,000
d. Pounds of subproduct resulting..	600,000	600,000	600,000
e. Standard cost adopted for subproduct....................	12¢	12¢	12¢
f. Value allocated to subproduct ($d \times e$)....................	$72,000	$72,000	$72,000
g. Remainder, value of main product ($c - f$)..............	$328,000	$368,000	$428,000
h. Pounds of main product materials ($b - d$)....................	1,400,000	1,400,000	1,400,000
i. Value per pound, main product ($g \div h$)....................	23.4¢	25.6¢	30.6¢

Thus with a standard cost for one product, any fluctuations in the joint costs, whether up or down, are reflected in the other product with added emphasis. In the cases shown, an increase of 5 cents in the price of raw materials gives an increase of 7.2 cents in the price allocated to the principal material; and this contains no charge for labor and burden in processing.

Material Costs in Proportion to Selling Values

To avoid this, the attempt is usually made to apportion the costs between the two products in proportion to their selling values; the costs of subsequent processes may be deducted from the sales value of the respective products before the computation of the joint costs is made. In this way the costs will move with the selling prices, and each product is, so to speak, loaded with what it will bear. This is sound business; the interest of the manufacturers in the two products really is in proportion to what they can get out of them in the market.

This method is probably the one most commonly followed in practice, where any allocations are made at all. It may be illustrated by the following example:

Raw materials put into process	1,000,000 lb.
Cost per pound	30¢
Value of raw materials	$300,000
Labor and burden in early processes	100,000
Total costs up to point of division	$400,000

Results obtained from foregoing processes:

	Pounds Obtained
Material A	500,000
Material B	200,000
Waste recovered	250,000
Lost in process	50,000

The task is now to divide the total costs of $400,000 among the first three items, and the calculations will proceed as follows:

Product	Pounds	Ultimate selling value	Cost of subsequent processing	Net selling value of materials	Proportionate cost of materials	Cost per pound
A	500,000	$490,000	$130,000	$360,000	$312,000	62.4¢
B	200,000	110,000	20,000	90,000	78,000	39
Waste	250,000	10,000		10,000	10,000	4
Total	....	$610,000	$150,000	$460,000	$400,000	

This means that at the point of separation Material A will be valued at 62.4 cents per pound, and Material B at 39 cents per pound, and these materials will be charged into the subsequent processes at these prices. As for the waste materials, it will be seen that they are simply carried at what they will sell for and are subtracted from the total material costs at that value. This leaves $390,000 to be divided between A and B materials. It will be noted that A and B are the products only in the earlier processes and become the materials for the later processes.

Fixed Fraction Method

A third method is to charge a fixed fraction of the total cost to each product. This has the advantage of simplicity, but it also will be thrown out of line if the products should materially change their relative importance, as have the light oils and heavy oils, all made from crude oil, with the development of the internal-combustion engine. Nevertheless, where conditions remain fairly stable, this third method may be used to get substantially the same results as those obtained by the second method; if the fixed fractions are determined in proportion to the selling prices but are changed from time to time if selling prices change substantially, then costs which are in proportion to the selling prices will be obtained, but without the trouble of making detailed computations after every little change in the selling price.

To sum up, the only rational method, and the most common in practice, is to cost joint products in proportion to their selling prices; but if a fixed ratio is found to prevail between these prices, a simple fraction may be used for dividing the costs easily between the two products, and this fraction can be changed as circumstances require.

Some Industries with Joint Products

The discussions which have been given will be made much clearer by a few actual examples of industries in which this problem of joint cost appears, and how it is in fact handled. It will be seen again how the circumstances of the case and the manufacturing and selling practices of the particular industry govern the accounting procedure.

The practices of three different industries will therefore be described, namely, corn products refining, oil refining, and meat packing. This problem arises in many industries, but an account of the special features and procedures of these three industries will give a representative view of the practical handling of this problem.

Corn Products Refining

In the corn products industry corn is divided, by a number of cooking and refining processes, into some twenty or thirty different products. The first process, or series of processes, is known as the wet starch process; in it the grain is steeped and cooked to the point where it may be separated into its main elements. Of these the largest in bulk and value is starch, constituting most of the inside white kernel. The other elements are the hulls and gluten, which are developed mostly into cattle feeds or fertilizers, and oil which is expressed from the mass. This oil is relatively small in quantity but is the most valuable product per pound weight.

It is on the division of products at this point that the main scheme of cost accounting depends. The oils and feeds are commonly treated as by-products or residues and are valued at their going market values, leaving the other costs to rest upon the starch and products derived from it.

The way in which this is done is to have a By-products account in which are credited the sales amounts for gluten feed, crude oil, and oil meal. In this account are debited the beginning inventory and all the expenses of processing the by-products after they have been separated from wet starch. On the credit side will also be entered the market value of the inventories of these by-products on hand at the end of the period, which, of course, is brought down as a debit balance in the same account for the next period. The balance of the entire By-products account then represents the net proceeds of the by-products, that is, the excess of their sales value over the separate cost of processing them. This amount is debited in the By-products account and credited in the Wet Starch account and is assumed to be the value of that part of the materials which has gone into by-products. This closes the By-products account for this period.

The other product resulting from the wet starch process is raw starch, and this is used in making various prepared starches, glucose, and sugar. All starch used for these purposes is credited in the Wet Starch account and debited to the proper account for the other product, at a flat rate per pound representing the cost of production for that month, after giving credit for the net proceeds of the by-products. The real business problem in this connection is to watch the market prices of these various sugars and starches and to see which of the products are selling at the best prices and will therefore give the greatest profits. Since the raw starch, as derived from the wet starch process, may be used for any one of these products, it will naturally be devoted to those products which currently show the best return. A problem on this industry is given at the end of this chapter which will help to make these practices clear.

Oil Refining Industry

The oil refining industry affords an example of the use of selling prices of the products to determine the costs. The refining processes are numerous and complex, and very many products are obtained in the course of them. Below is a list

Number	Process	Raw material	Products
I	Crude still	Crude oil	Crude naphtha Kerosene distillate Gas oil Wax distillate Tar residue
II	Agitator 1	Crude naphtha	Gasoline Finished naphtha Wax distillate
III	Tar still	Tar residue	Kerosene distillate Wax distillate Coke
IV	Filter presses	Wax distillate	Slack wax Pressed distillate
V	Sweaters, filter, and molding	Slack wax	Molded wax
VI	Reducing still	Pressed distillate	Unfiltered lubricating oils Gas oil
VII	Filters 1 and 2	Unfiltered lubricating oils	Filtered oils
VIII	Agitator and bleacher tank	Kerosene distillate	Kerosene

of the principal processes and of the main products derived from them; there are, of course, many modifications and special divisions of these products in practice.[1]

In the first process, for example, crude oil as obtained from the wells is split into five products. The account for that process is debited with the cost of crude oil entered into process and with all the manufacturing costs. The five products all have regularly quoted market prices. To avoid the daily fluctuations, it is customary to use the average prices for the past six months. The total costs of the process are therefore divided among the five products in proportion to their market values.

One of these products, crude naphtha, is then used as the raw material for process II, and the value thus obtained on it in process I is used to credit the crude naphtha inventory account and to charge it to the account for process II. Here the same accounting procedure is repeated; the labor and burden expenses of process II are charged to it and the total costs obtained are divided among the three products of the process in proportion to their market values. The same methods are repeated with all the processes. It will be seen that the procedure is designed not only to supply a cost for each of the various products but also to supply its inventory value.

Another Treatment of the Oil Problem

The preceding paragraph explains the typical method of handling joint costs in the oil industry, as applied to the financial accounting. But here arises an example of what has been said elsewhere to the effect that in special studies outside the books one is not necessarily bound by the same considerations as relate to the financial records. In one study made in the oil industry the attempt was made to discover which of a number of refineries were most economical to operate, all things being taken into account. For this purpose another method of allocating the costs of crude oil was used. It was based on the fact that, by the hydrogenation process, most of the different oils could be converted into gasoline. True, the processing cost would vary for each type of oil, and these various costs would be used to find their value for gasoline manufacture. To adopt some illustrative figures, the method would be about as follows:

---

[1] MORLAND and MCKEE, *Accounting for the Petroleum Industry*, McGraw-Hill Book Co., Inc., p. 183.

1. Parts of crude	1	2	3	4	5
2. Costs to convert into gasoline	2¢	2½¢	3¢	3½¢	4¢
3. Selling price, gasoline	10¢	10¢	10¢	10¢	10¢
4. Value of each part for gasoline manufacture	8¢	7½¢	7¢	6½¢	6¢

The numbers in the first line represent progressively heavier oils coming from the crude when it is broken down in the refinery. Going from left to right, therefore, they cost more to convert into gasoline, as shown in line 2. But the selling price of gasoline was 10 cents, regardless of the source of it (line 3). As a result, line 4 shows the value of each kind of oil for gasoline purposes, and these were the values put upon them for purposes of the special study. But in the ledgers the matter was handled on the ordinary basis of allocating the costs of the crude to the various subproducts in proportion to the selling values, and the special study did not disturb this practice.

Meat Packing Industry

The meat packing industry resembles the corn products refining in that one product, or group of products, is regarded as the main product of operations and all others as by-products. The main product in this case is dressed meat, and all other products such as hair, hides, and wool are treated as by-products. The costs of handling these by-products and of preparing them for market are gathered together and are subtracted from the income obtained by selling the by-products, thus again securing a figure known as net proceeds of by-products. This figure is credited in the main Manufacturing account, where it serves as a subtraction from the main manufacturing costs and reduces the cost of dressed meat accordingly.

There has been in years past considerable public discussion as to the wisdom of this form of accounting in the meat packing industry. It has been argued that the total costs should be apportioned among all products, in similar manner to the procedure described for the oil industry, and thus show a profit on every product. But the packers have continued to maintain that their best interest and the interest of their customers are served by treating everything except dressed meat as by-products. They claim among other things that they are thereby enabled to know how much they can afford to pay for live animals, and that the selling prices thereby determine the costs rather than the costs determining the selling prices.

QUESTIONS AND PROBLEMS

1. Prepare the process accounts for the month of September for the Deven Corn Company in accordance with the data given.

The processing accounts, with the balances of those containing inventories, were as follows on September 1, 1928:

Boiler House		
Engine House		
General Expense		
Sugar Refinery		
Repairs		
By-products Account	$ 60,000	
Wet Starch	20,000	
Powdered Starch	12,000	
Prepared Starch		
Dextrine		
Glucose	12,000	
Sugar	5,000	
General Ledger Control		$109,000
	$109,000	$109,000

During the month manufacturing expenses were incurred as follows:
Coal Used:

In Boiler House	$30,000
In Sugar Refinery	1,200

The analysis of the direct labor payroll was as follows:

Boiler House	$ 3,500
Engine House	800
Sugar Refinery	600
By-products	7,500
Wet Starch	15,000
Powdered Starch	3,500
Prepared Starch	1,500
Dextrine	2,700
Glucose	4,000
Sugar	8,000
Total	$47,100

Indirect labor of various types amounted to:

Officers' Salaries	$ 6,000
Office Salaries	8,000
Repair Labor	13,500
Total	$27,500

The first two items were charged to General Expense.

Supplies were used as listed:

Boneblack for Sugar Refinery	$ 7,700
Repair Materials	13,000
Supplies Used for By-products	8,000
Used in Wet Starch Department	1,000
Powdered Starch	150
Prepared Starch	1,200
Dextrine	3,500
Chemicals used in Glucose Department	10,000
Chemicals used in Sugar Department	11,000
Total	$55,550

There were 500,000 bu. of corn at an average cost of 96¢ per bushel put into process in the wet starch department.

Other expenses included:

Office Expense	$ 4,000
Miscellaneous Expense	1,800
Administrative Expense Connected with By-products	7,600
Selling Expense for By-products	13,000
Total	$26,400

The total repair expenses were allocated to the departments on the basis of records kept for the repair work done in them; the charges were as follows:

Boiler House	$ 1,500
Engine House	400
Sugar Refinery	400
Residues	7,000
Wet Starch	11,800
Glucose	1,000
Sugar	2,300
Powdered Starch	1,400
Prepared Starch	200
Dextrine	500
Total	$26,500

These charges represented a complete distribution of the Repairs costs and were credited in total to that account.

Distribution of the boiler house charges was made by the plant superintendent, who estimated the steam consumption of the several departments at the end of each month, taking into account both the capacity and the current production of the departments. The resulting charges to departments were:

Engine House	$18,900
Sugar Refinery	2,400
By-products, Feed, Oil, and Meal	2,100
Powdered Starch	2,000
Prepared Starch	400
Dextrine	700
Glucose	2,500
Sugar	6,000
Total	$35,000

The engine house costs also were distributed monthly by the superintendent on the basis of the estimated power consumption of the departments, as follows:

Wet Starch	$16,000
Glucose	1,800
Sugar	2,300
Total	$20,100

General Expense, which included Officers' Salaries, Office Salaries, Office Expenses, and Miscellaneous Expenses, was distributed to product accounts in proportion to the pounds of product produced, excluding by-products. No direct charge was made to dextrine, since that product was made from powdered starch and it was necessary to avoid a duplicate charge, For this purpose the calculation was made on the gross amount of powdered starch made, not on the net amount.

The sugar refinery department was a filtration process for the early stages of manufacture of glucose and sugar. This department was always credited with the amount of spent boneblack which resulted from it, and which in September amounted to $2,500. The balance of the account was then apportioned between glucose and sugar in proportion to the pounds made of each.

Sales of by-products for the month were as follows:

Gluten Feed	$150,000
Crude Oil	65,000
Oil Meal	13,000
Total	$228,000

An inventory valued at $55,000 remained on hand in this department at the end of the month. It was customary to transfer the net proceeds of this department to the Wet Starch account as a credit before determining the net costs of other products.

Transfers were made from the wet starch department as follows:

To Powdered Starch	$ 70,000
To Prepared Starch	10,000
To Glucose	120,000
To Sugar	160,000
Total	$360,000

The balance of the Wet Starch account was then the inventory in process at the end of the month.

Powdered starch was transferred to the dextrine department to the value of $23,400, and powdered starch worth $58,500 was finished during the month. The balance of the account was then the month-end inventory in process.

In the prepared starch department, batches were put through and finished very quickly so that there was no inventory in process at the end of the month; the total charges represented the value of goods made during the month. The same thing was true of the dextrine department.

In the glucose department, on the other hand, there was a final inventory of $10,000, and in the sugar department an inventory of $4,000; the balance of these accounts represented the cost of goods finished during the month.

PRODUCTION DURING SEPTEMBER, 1928

	Pounds
Powdered Starch, Net	1,000,000
Prepared Starch	500,000
Dextrine	2,500,000
Glucose	6,000,000
Sugar	8,000,000
Total	18,000,000
Residues:	
Gluten Feed	4,000,000
Crude Oil	400,000
Oil Meal	600,000
Total	23,000,000

A gross total of 18,000,000 lb. of starch was made, of which 3,500,000 lb. was converted into powdered starch, 500,000 lb. into prepared starch, 6,000,000 lb. into glucose, and 8,000,000 lb. into sugar.

Of the 3,500,000 lb. of powdered starch, 2,500,000 lb. was converted into dextrine, the balance being sold or stored as powdered starch.

2a. Calculate the cost per gallon of the products of the first two processes of an oil refinery from the following facts:

Crude oil put into first process, 2,500,000 gal. at 4¢.
Labor of processing, $2,800; burden, $4,200.
Products resulting from operations:

	Gallons produced	Average selling prices
Crude naphtha	700,000	10.00¢
Wax distillate	500,000	8.50
Gas oil	450,000	4.00
Kerosene distillate	450,000	8.00
Tar	350,000	2.50
Loss in processing	50,000	
Total	2,500,000	

Into the second process were put 500,000 gal. of crude naphtha, namely, 300,000 transferred from the foregoing process, and 200,000 gal. from an inventory carried at an average value of 7¢ per gallon.

Labor on this process, $1,400; expense burden, $1,500. The products resulting were:

	Gallons	Average selling price
Gasoline	360,000	12.00¢
Finished naphtha	90,000	10.50
Wax distillate	30,000	8.50
Loss in processing	20,000	
	500,000	

b. Show the process accounts in ledger form for these processes, and enter in them the debits and credits to reflect the foregoing information, and that shown in your answers to Question *a* above.

3. Assume the same results of the first refining process as in the preceding question, namely,

	Gallons produced	Cost to convert to gasoline
Crude naphtha	700,000	0.60¢
Wax distillate	500,000	1.90
Gas oil	450,000	6.00
Kerosene distillate	450,000	2.60
Tar	350,000	
Loss in processing	50,000	

If the average selling price of gasoline is 12¢ per gallon, show the cost per gallon at which each of the first four products would be transferred to the other manufacturing departments. On this occasion assume that the transfers are to be made on the basis of their value for gasoline purposes.

PART III

TYPICAL CASES OF COST ACCUMULATION AND REPORTS

XVII

THE FORREST ELECTRICAL COMPANY

A CASE IN JOB COSTS

Character of This Chapter

This chapter presents a system of cost accounting used by a concern manufacturing small motors and other electrical apparatus; after the system is described, material is presented for a problem.

Products Made

The Forrest Electrical Company's products could be conveniently grouped into two classes: products of standard design and products of special design. The products of standard design comprised the greater portion of the company's production and were produced largely for stock. The company did not usually stock the completed unit but manufactured the individual parts necessary to build a motor or other apparatus. The complete unit was then assembled upon receipt of a customer's order, at which time the parts were requisitioned from stock and the motor or apparatus assembled. This procedure was followed partly because it was easier to store parts than completely assembled motors and partly to reduce the amount of investment in the inventory.

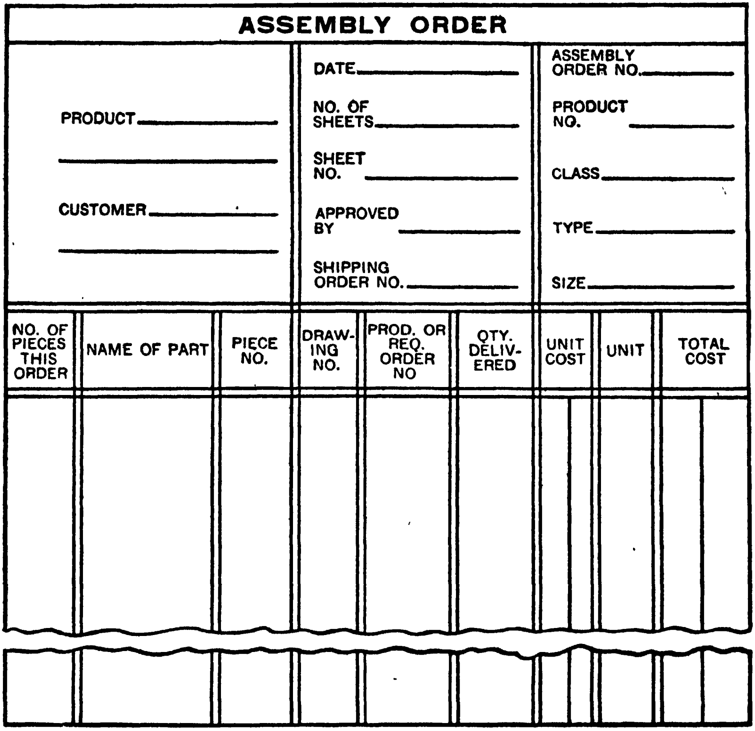
The products of special design comprised the smaller portion of the company's production and were generally made according to customers' specifications. Occasionally sundry parts from standard stock could be used in these orders; but in most cases special orders required special parts throughout, which necessitated individual production.

The Company's Accounting System

The description given here of the accumulation of costs of material, labor, and overhead deals largely with the assembly of units; less attention is given to the production costs of the individual parts used in assembly. These, however, follow closely the methods used in this case for production orders. The description of the system is divided into three sections, one on each of the elements of costs.

Material Costs

The materials used in assembly were the individual parts which had been manufactured and placed in stock. A perpetual inventory was kept for these parts, which were issued only on proper requisition from production departments. Materials issued were priced at standard prices, principally to simplify the computation of material costs. When an invoice for raw materials was received, a sticker was attached to it (shown in Form 6, page 66) on which an analysis of the purchase price was made; materials were taken into stock at standard prices, and variations were entered immediately in an account in the general ledger called Loss and Gain on



ASSEMBLY ORDER

PRODUCT ____

CUSTOMER ____

DATE ____

NO. OF SHEETS ____

SHEET NO. ____

APPROVED BY ____

SHIPPING ORDER NO. ____

ASSEMBLY ORDER NO. ____

PRODUCT NO. ____

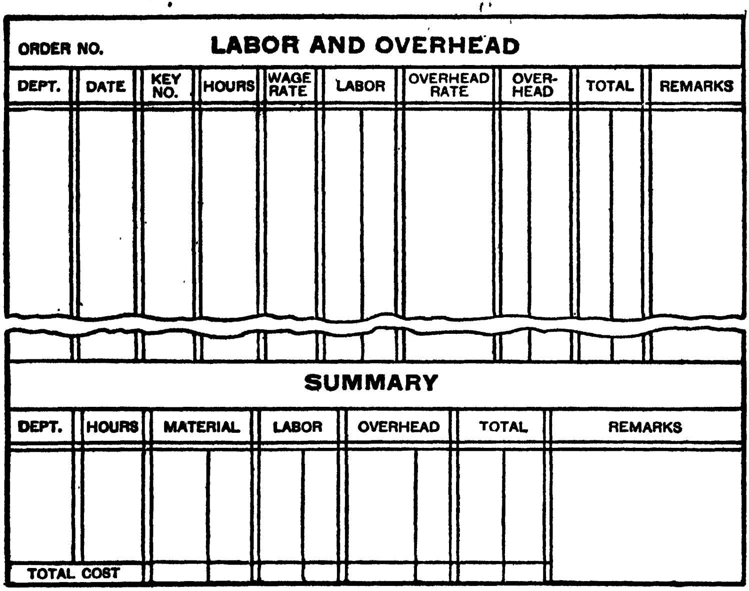
CLASS ____

TYPE ____

SIZE ____

NO. OF PIECES THIS ORDER	NAME OF PART	PIECE NO.	DRAWING NO.	PROD. OR REQ. ORDER NO	QTY. DELIVERED	UNIT COST	UNIT	TOTAL COST

Form 54: Assembly order—front.



ORDER NO.

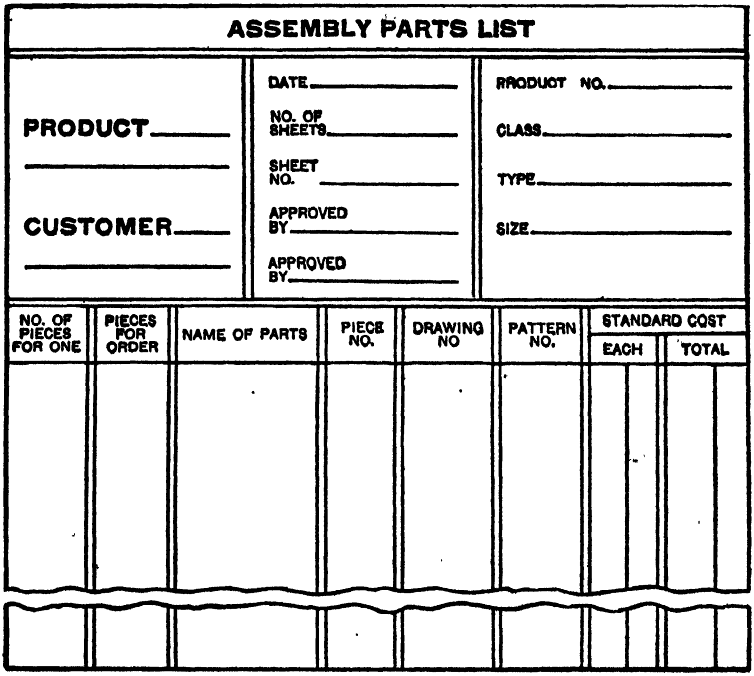
LABOR AND OVERHEAD

DEPT.	DATE	KEY NO.	HOURS	WAGE RATE	LABOR	OVERHEAD RATE	OVER-HEAD	TOTAL	REMARKS

SUMMARY

DEPT.	HOURS	MATERIAL	LABOR	OVERHEAD	TOTAL	REMARKS
TOTAL COST						

Form 55: Assembly order—back.



ASSEMBLY PARTS LIST

PRODUCT______

CUSTOMER______

DATE______

NO. OF SHEETS______

SHEET NO.______

APPROVED BY______

APPROVED BY______

PRODUCT NO.______

CLASS______

TYPE______

SIZE______

NO. OF PIECES FOR ONE	PIECES FOR ORDER	NAME OF PARTS	PIECE NO.	DRAWING NO	PATTERN NO.	STANDARD COST	
						EACH	TOTAL

Form 56: Assembly parts list.

Purchases. Similarly, when parts were manufactured, they were put into finished parts stock at standard prices; the differences between these standard prices and the actual costs of the parts were cleared into a Loss and Gain on Factory Orders, Parts, account.

How Standard Parts Were Ordered

When a sales order was received, a copy of it was sent to the engineering department where it was checked to determine whether the units called for were of standard or special design. If the order was for units of standard design, the planning department issues two orders: (1) an assembly order, which authorized the factory to assemble a designated number of units of the specified type; and (2) an assembly parts list, a single requisition on stores to supply the assembly department with all the parts necessary to make up the units called for by the assembly order. A sample of each of these orders is given on page 313.

How Special Parts Were Ordered

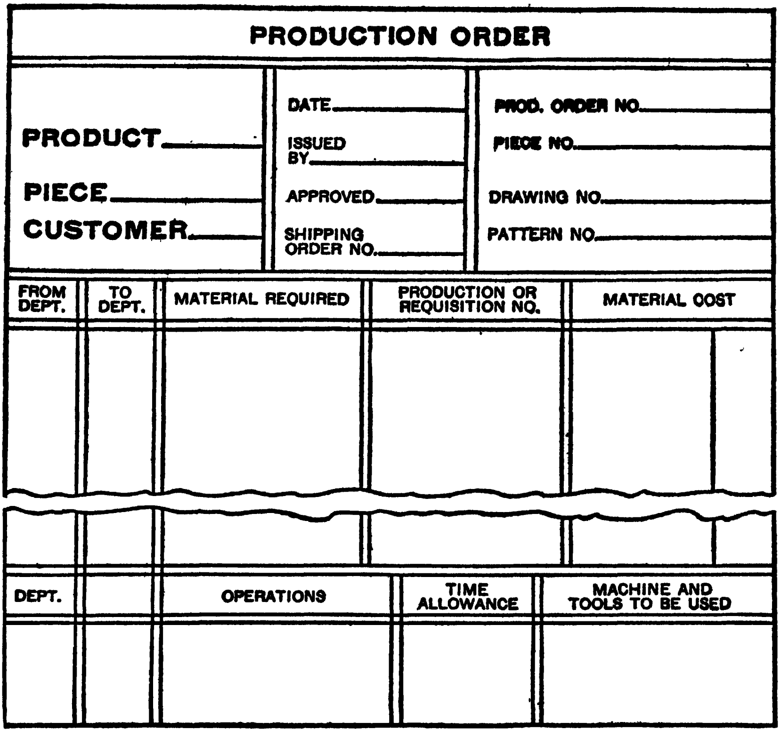
Sometimes certain standard parts were not in stock, or a particular order for a unit of mainly standard design might call for one or more special parts. In these cases a production order was issued for the production of the parts not in stock or for the special parts needed. This form was also regularly used to order standard parts to be made for stock. A sample of a production order is given on page 315.

Correction of Defective Work

If any mistake or mishap occurred which caused the products being manufactured under the production order to fail to agree with the specifications, a new order was issued for other parts to replace the defective work. This order was called a "correction production order"; it was identical with the original production order except in name, and a reference number was used to show clearly that it related to the original production order under which it was issued.

Labor

The Forrest Electrical Company paid productive labor on three different bases, namely, (1) straight hourly rate, (2)



PRODUCTION ORDER

PRODUCT
PIECE
CUSTOMER

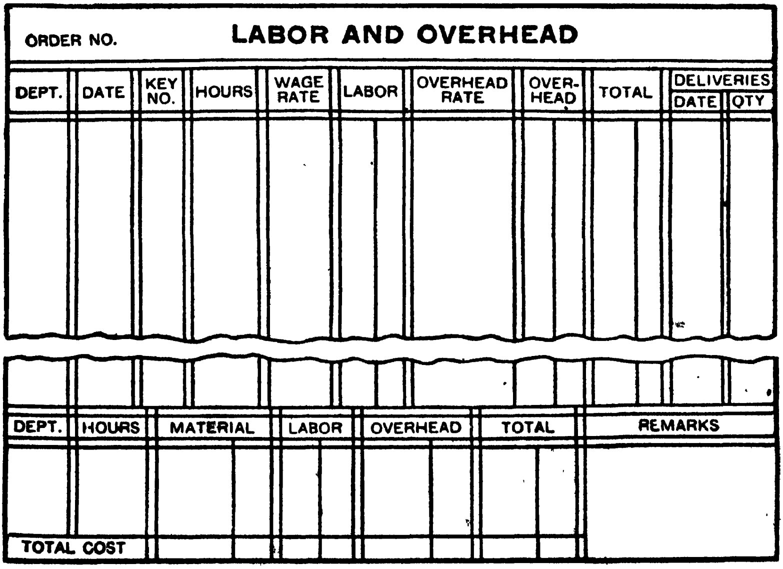
DATE
ISSUED BY
APPROVED
SHIPPING ORDER NO.

PROD. ORDER NO.
PIECE NO.
DRAWING NO.
PATTERN NO.

FROM DEPT.	TO DEPT.	MATERIAL REQUIRED	PRODUCTION OR REQUISITION NO.	MATERIAL COST

DEPT.		OPERATIONS	TIME ALLOWANCE	MACHINE AND TOOLS TO BE USED

Form 57: Production order—front.



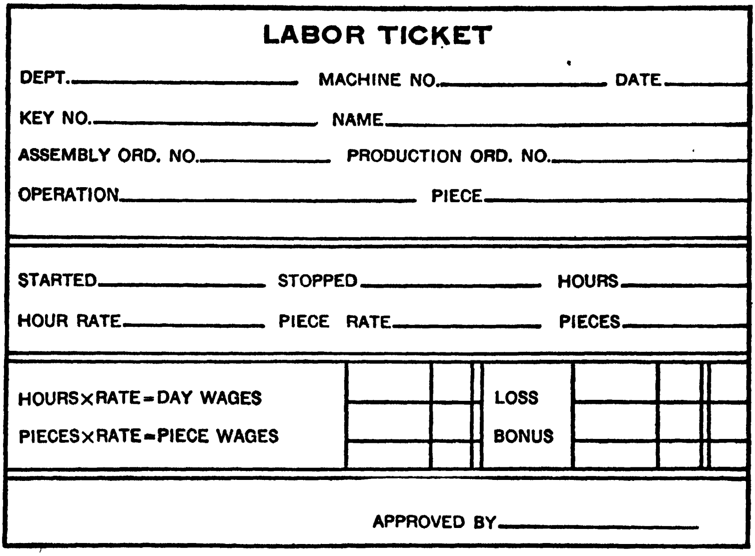
ORDER NO.

LABOR AND OVERHEAD

DEPT.	DATE	KEY NO.	HOURS	WAGE RATE	LABOR	OVERHEAD RATE	OVER-HEAD	TOTAL	DELIVERIES	
									DATE	QTY

DEPT.	HOURS	MATERIAL	LABOR	OVERHEAD	TOTAL	REMARKS
TOTAL COST						

straight piece rate, and (3) in some cases a guaranteed hourly rate with a bonus for high production. The type of work determined the method of wage payment. Only the last of the three methods requires an explanation. As a basis for figuring the bonus a piece rate was established for each job and an hourly rate for each man. The number of good pieces completed on a job was multiplied by the predetermined piece rate to give the standard labor cost, or the man's piece-rate earnings. To determine the workman's wages on the guaranteed wage basis, the number of hours worked on the job was multiplied by the workman's hourly rate. If the amount computed from the piece rate was larger in amount than the hourly wages computed on the guaranteed basis, the man was paid the difference as a bonus. If, on the other hand, the piece rate amount was less, the workman was paid his regular hourly wages. Losses were not deducted from bonuses earned. The labor ticket used for this purpose is given in Form 59.



LABOR TICKET

DEPT.________ MACHINE NO.________ DATE________
KEY NO.________ NAME________
ASSEMBLY ORD. NO.________ PRODUCTION ORD. NO.________
OPERATION________ PIECE________

STARTED________ STOPPED________ HOURS________
HOUR RATE________ PIECE RATE________ PIECES________

HOURS×RATE=DAY WAGES				LOSS			
PIECES×RATE=PIECE WAGES				BONUS			

APPROVED BY________

Form 59: Labor ticket.

Gathering Labor Costs

The labor tickets were collected daily and sorted by key or employee number. The total hours of day work and the total hours of piece work were then entered on the employees' weekly pay record, which was a daily and weekly summary of each man's work on both day and piece basis. This statement is shown in Form 25, page 124.

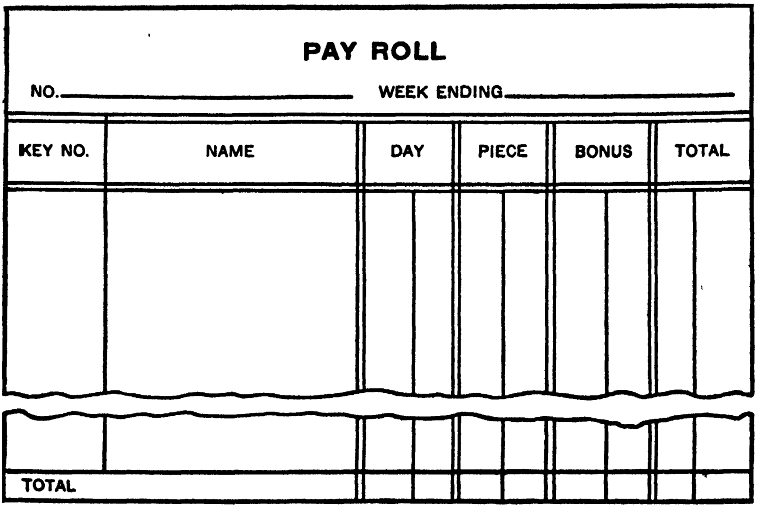
The column headed D.W. under each day of the week was for the number of hours worked on straight day work. The column headed P.W. contained the number of pieces made each day if the man was on straight piece work without bonus; but if he was on the guaranteed hourly minimum with bonus, it contained the number of hours worked each day. These figures were accumulated in the total column at the right, and the man's weekly wage at the guaranteed hourly minimum was computed. Then the amount of bonus earned, as computed on the statement of completed piece-work jobs and bonus earned, was brought over in one total and inserted in the Bonus column. On account of the work involved the computing of these bonuses was always one week late; hence the amount a man received in a given week was his hourly wage for that week, plus the bonus, if any, for the previous week.

The form of this record also is included in Form 25, page 124. The job ticket there given is, however, different from Form 59 in this chapter; both forms were used by the Forrest Electrical Company, but for different classes of work.

The computation of the bonus was somewhat more difficult than the computation of the workmen's piece or day wages, since the bonus could not be determined until the whole job was completed. A job which was started in one week might not be completed until the following week and the bonus was not figured until the job had been completed. As stated before, the bonus was not paid until one week after completion of the jobs. In order that there might be no misunderstanding between the workman and the company about the amount of the bonus to be paid, the company each week made up a statement known as a bonus slip and placed it in the workman's pay envelope.

Bonuses were added to the employee's regular wage and the total amount paid to all workers was charged to Goods in Process. Thus in those cases where a workman failed under the piece rate to make his guaranteed hourly rate, the guaranteed wage was charged to Goods in Process. No record was made in the company's accounts of the loss due to guaranteeing wages, but note was taken of it in the management of the labor force.

To obtain the payroll for the period, the totals were taken from the employee day record and bonus statement and accumulated on the payroll sheet which is given below. This sheet was made up on Thursday of each week.



PAY ROLL

NO.____________ WEEK ENDING____________

KEY NO.	NAME	DAY	PIECE	BONUS	TOTAL
TOTAL					

Form 60: Form of payroll.

Overhead

The company had a complete and adequate system of distributing burden to the productive departments. Within the departments, burden was charged to jobs upon the direct labor-hour basis.

Because of the nature of the Forrest Electrical Company's business, developmental costs and shipping and packing costs were high. Consequently, instead of including these items in the hourly rates for burden, they were expressed in their own individual percentage rates, which were figured on and added to the total factory cost. Thus the general plan of costing for a job was as indicated by the following summary figures:

Total Direct Materials	$146.00
Total Direct Labor	174.00
Total Manufacturing Burden	110.00
Total Manufacturing Costs	$430.00
Add: Standard Development 2½%	10.75
Packing and Shipping 5%	21.50
Total	$462.25

There are therefore three burden additions, one for manufacturing, one for packing, and one for shipping.

Cost Ledger Control

The factory of the Forrest Electrical Company was treated as a separate department of the business. A factory ledger was kept which contained all the raw material accounts, the work in process accounts, the finished parts accounts, the labor accounts, and burden accounts. This ledger was self-balancing because it contained a General Ledger Control account which carried in totals the credits for the offsetting debits to the accounts already mentioned. A Factory Ledger Control account was kept in the general ledger at the main office, which was always kept in agreement with the General Ledger Control account on the factory ledger. When jobs were completed, they were credited to the factory at a standard or predetermined cost per unit. That is, in the factory ledger Goods in Process was credited and General Ledger Control was debited; in the general ledger, Cost of Goods Sold was debited for goods made to order and shipped at once; Finished Goods was debited for goods made for stock, and the credits for both were to Factory Ledger Control.

TRANSACTIONS PRESENTED FOR PROBLEM

Sales Order Received

The sales order, No. 16357A, shown on page 320; was received.

To produce the motors required to fill the sales order given above, the following factory orders were issued: assembly order A-64321, and under that production orders P-76288, P-76287, and correction order CP-77858.

Prepare all these four manufacturing orders, using the data given below.

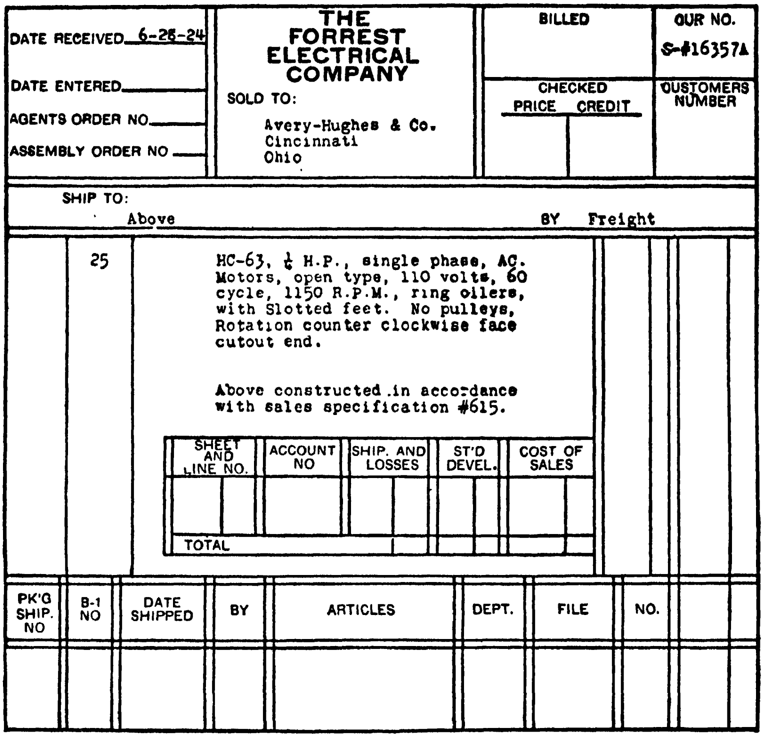
Assembly Order A-64321

On July 2, 1924, the factory planning department issued assembly order A-64321 to start production on the motors called for in sales order 16357A. The material required was: 25 sets of mechanical parts per standard parts list HC-63 which is given as Form 62.

Using this standard parts list as a basis, prepare the assembly parts list for 25 motors.

Production Order P-76288

Production order P-76288 was issued July 3, 1924, under the foregoing assembly order. This production order called for 25 shaft and rotor assemblies which were not in stock. The material needed to fill this order was as follows:



DATE RECEIVED 6-26-24
DATE ENTERED
AGENTS ORDER NO.
ASSEMBLY ORDER NO

THE
FORREST
ELECTRICAL
COMPANY

SOLD TO:
Avery-Hughes & Co.
Cincinnati
Ohio

BILLED

CHECKED
PRICE CREDIT

OUR NO.
S-#16357A

CUSTOMERS NUMBER

SHIP TO:
Above
BY Freight

25

HC-63, ¼ H.P., single phase, AC. Motors, open type, 110 volts, 60 cycle, 1150 R.P.M., ring oilers, with Slotted feet. No pulleys, Rotation counter clockwise face cutout end.

Above constructed in accordance with sales specification #615.

SHEET AND LINE NO.	ACCOUNT NO	SHIP. AND LOSSES	ST'D DEVEL.	COST OF SALES
TOTAL				

PK'G SHIP. NO	B-1 NO	DATE SHIPPED	BY	ARTICLES	DEPT.	FILE	NO.	

Form 61: Sales order.

25 rotors 37 bars No. 5 copper piece 8707—From Department 5
25 shafts B/P 32540—From Department 5
25 cutouts (set —0—900 r.p.m.) piece 8493
25 fans—piece 52137

These parts were to be delivered to Department 17, where the following operations were to be performed: rough turn rotor, press in shaft, mount cutout and fan, straighten shaft, finish turn rotor and balance. After these operations the material was to be inspected and delivered to stores 3, for the assembly department.

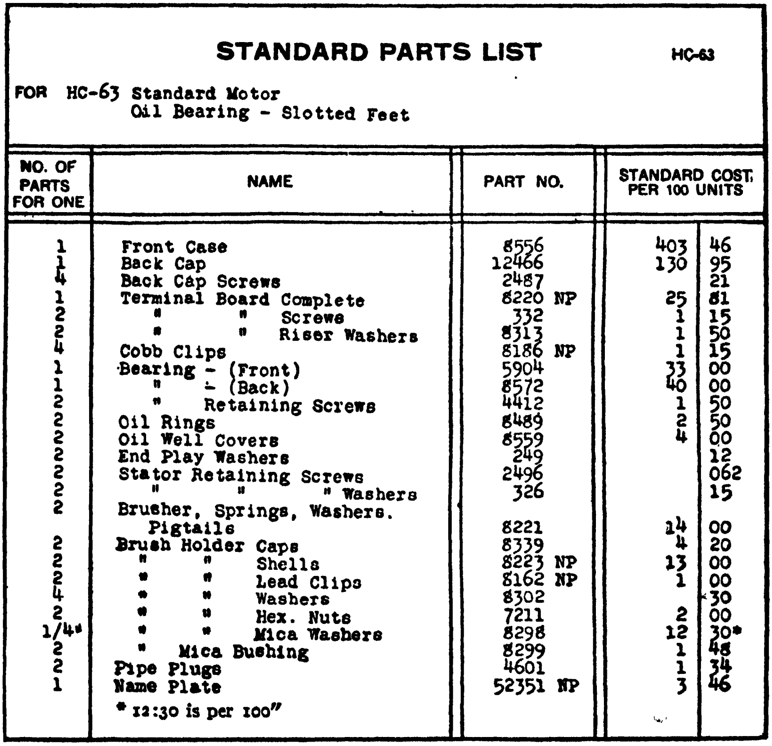
Production Order P-76287

Production order P-76287 was issued on July 3, 1924, under assembly order A-64321. This production order called for:

25 HC-63 stators—engineering specifications 9547, lead diagram C-90303

The material required to fill this order was as follows:

25 stator cores—piece 10162
56 lb. 4-oz. No. 20 E.C. wire
12 lb. 8-oz. No. 22 E.C. wire



STANDARD PARTS LIST HC-63

FOR HC-63 Standard Motor
Oil Bearing - Slotted Feet

NO. OF PARTS FOR ONE	NAME	PART NO.	STANDARD COST. PER 100 UNITS	
1	Front Case	8556	403	46
1	Back Cap	12466	130	95
4	Back Cap Screws	2487		21
1	Terminal Board Complete	8220 NP	25	81
2	" " Screws	332	1	15
2	" " Riser Washers	8313	1	50
4	Cobb Clips	8186 NP	1	15
1	Bearing - (Front)	5904	33	00
1	" - (Back)	8572	40	00
2	" Retaining Screws	4412	1	50
2	Oil Rings	8489	2	50
2	Oil Well Covers	8559	4	00
2	End Play Washers	249		12
2	Stator Retaining Screws	2496		062
2	" " " Washers	326		15
2	Brusher, Springs, Washers. Pigtails	8221	14	00
2	Brush Holder Caps	8339	4	20
2	" " Shells	8223 NP	13	00
2	" " Lead Clips	8162 NP	1	00
4	" " Washers	8302		30
2	" " Hex. Nuts	7211	2	00
1/4*	" " Mica Washers	8298	12	30*
2	" Mica Bushing	8299	1	48
2	Pipe Plugs	4601	1	34
1	Name Plate	52351 NP	3	46

* 12:30 is per 100"

Form 62: Standard parts list.

All this was to be taken from Department 5 to Department 21.

Only one operation, namely, winding, was to be performed in Department 21. After this work was completed, the goods were to be delivered to stores 3.

Correction Order CP-77858

During the process of manufacture a ground developed in one of the stators and it was necessary to issue a correction order CP-77858 which was issued on August 12, 1924. It read as follows:

> Repair ground—work to be done in Department 21 and article to be delivered to Department 24

Materials Used

A summary of material requisitioned and issued on assembly order A-64321 and its supplementary production orders is given below:

DATE OF ISSUE	NAME	PIECE NO.	TO DEPT	FROM DEPT.	NO. OF UNITS	UNIT COST	TOTAL COST	ASSEMBLY OR PROD. ORDER
7-2-24	Set Parts per List - HO 63							
7-2-24	Stator Cores	10162	21	5	25	7 42	185 62	A-64321
	#20 EC Wire		21	5	25		58 75	P-76287
	#22 EC Wire		21	5	53.69 lbs		22 34	P-76287
7-3-24	Rotors - 37 Bars				16.61 lbs		7 44	P-76287
	#5 Copper	8707	17	5				
	Shafts	32540	17	5	25		41 25	P-76288
	Cutouts Set (0-900) RPM	8493	17	5	25		16 20	P-76288
	Fans	52137	17	5	25		36 75	P-76288
					25		5 25	P-76288

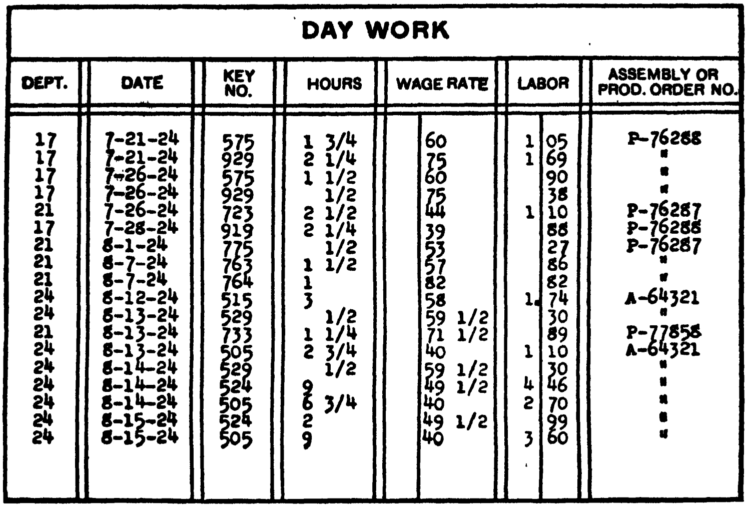
The items in the foregoing list of requisitions should be entered on the respective manufacturing orders to which they relate.

Labor Costs

An analysis of the job tickets applying to assembly order A-64321 and its supplementary production orders is given on pages 323–324. It should be noted that no actual record was kept in this form, which is only a summary of the individual tickets, prepared for the purposes of this problem. In practice the actual tickets themselves would be used for making up the payroll. Two such summaries are given here: Form 63 for day-work tickets and Form 64 for piece-work tickets.

The lists of labor tickets in Form 63 and Form 64 appeared in the payrolls as shown on page 324.

The labor costs shown here, in Forms 63 and 64, should be entered on the assembly or production order indicated for each item. The day-work amounts in Form 63 are ready to be entered. But from Form 64 the hourly rates and piece rates must be computed; if the piece rate is greater, that is the amount to be entered; otherwise the amount at the hourly rate must be entered.



DAY WORK

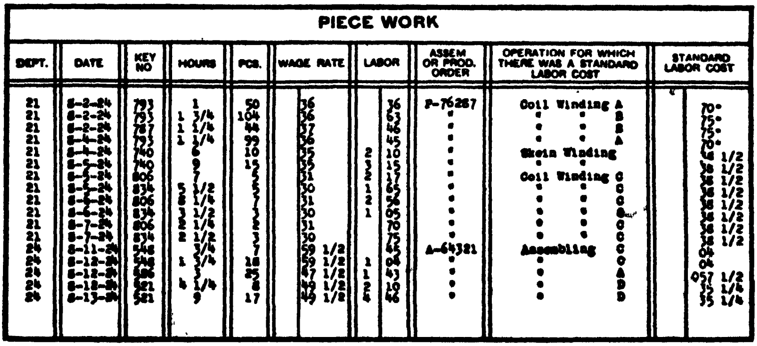
DEPT.	DATE	KEY NO.	HOURS	WAGE RATE	LABOR	ASSEMBLY OR PROD. ORDER NO.
17	7-21-24	575	1 3/4	60	1 05	P-76288
17	7-21-24	929	2 1/4	75	1 69	"
17	7-26-24	575	1 1/2	60	90	"
17	7-26-24	929	1/2	75	38	"
21	7-26-24	723	2 1/2	44	1 10	P-76287
17	7-28-24	919	2 1/4	39	88	P-76288
21	8-1-24	775	1/2	53	27	P-76287
21	8-7-24	763	1 1/2	57	86	"
21	8-7-24	764	1	82	82	"
24	8-12-24	515	3	58	1 74	A-64321
24	8-13-24	529	1/2	59 1/2	30	"
21	8-13-24	733	1 1/4	71 1/2	89	P-77858
24	8-13-24	505	2 3/4	40	1 10	A-64321
24	8-14-24	529	1/2	59 1/2	30	"
24	8-14-24	524	9	49 1/2	4 46	"
24	8-14-24	505	6 3/4	40	2 70	"
24	8-15-24	524	2	49 1/2	99	"
24	8-15-24	505	9	40	3 60	"

Form 63: List of day-work tickets.

Overhead

The company used the following burden rates:

Department	Cents per Hour
17	75
21	80
24	65

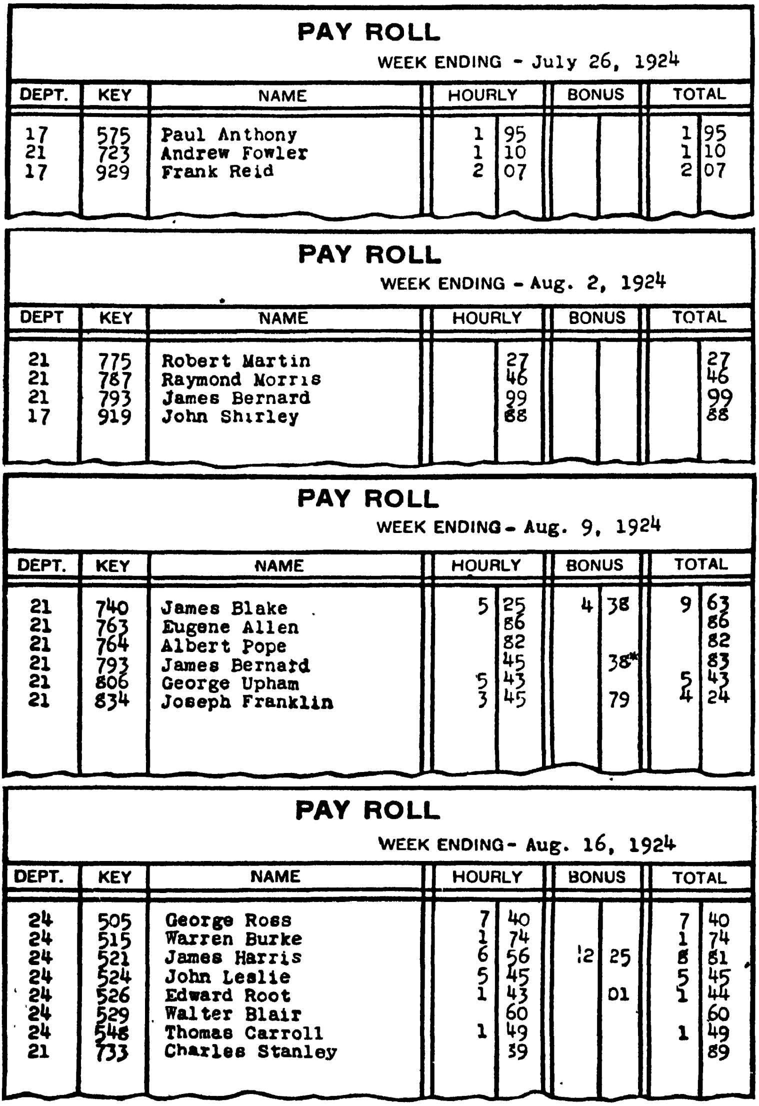


PIECE WORK

DEPT.	DATE	KEY NO	HOURS	PCS.	WAGE RATE	LABOR	ASSEM OR PROD. ORDER	OPERATION FOR WHICH THERE WAS A STANDARD LABOR COST	STANDARD LABOR COST
21	8-2-24	793	1	50	36	36	P-76287	Coil Winding A	70.
21	8-2-24	793	1 3/4	104	36	63	"	" " B	75.
21	8-2-24	787	1 1/4	44	37	46	"	" " B	75.
21	8-4-24	793	1 1/4	99	36	45	"	" " A	70.
21	8-4-24	740	6	10	35	2 10	"	Skein Winding	38 1/2
21	8-5-24	740	9	15	35	3 15	"	" "	38 1/2
21	8-5-24	806	7	5	31	2 17	"	Coil Winding C	38 1/2
21	8-5-24	834	5 1/2	5	30	1 65	"	" " C	38 1/2
21	8-6-24	806	8 1/4	7	31	2 56	"	" " C	38 1/2
21	8-6-24	834	3 1/2	3	30	1 05	"	" " C	38 1/2
21	8-7-24	806	2 1/4	2	31	70	"	" " C	38 1/2
21	8-7-24	834	2 1/2	3	30	75	"	" " C	38 1/2
24	8-11-24	548	3/4	7	59 1/2	45	A-64321	Assembling C	04
24	8-12-24	548	1 3/4	18	59 1/2	1 04	"	" C	04
24	8-12-24	586	3	25	47 1/2	1 43	"	" A	057 1/2
24	8-12-24	521	4 1/4	8	49 1/2	2 10	"	" D	35 1/4
24	8-13-24	521	9	17	49 1/2	4 46	"	" D	35 1/4

Form 64: List of piece-work tickets.

On the orders, therefore, the labor hours for each department should be found, and burden applied at the foregoing rates per hour. Then the total manufacturing cost may be shown in the summary on the front of each order, after which the



PAY ROLL

WEEK ENDING – July 26, 1924

DEPT.	KEY	NAME	HOURLY		BONUS		TOTAL	
17	575	Paul Anthony	1	95			1	95
21	723	Andrew Fowler	1	10			1	10
17	929	Frank Reid	2	07			2	07

PAY ROLL

WEEK ENDING – Aug. 2, 1924

DEPT	KEY	NAME	HOURLY		BONUS		TOTAL	
21	775	Robert Martin		27				27
21	787	Raymond Morris		46				46
21	793	James Bernard		99				99
17	919	John Shirley		88				88

PAY ROLL

WEEK ENDING – Aug. 9, 1924

DEPT.	KEY	NAME	HOURLY		BONUS		TOTAL	
21	740	James Blake	5	25	4	38	9	63
21	763	Eugene Allen		86				86
21	764	Albert Pope		82				82
21	793	James Bernard		45		38*		83
21	806	George Upham	5	43			5	43
21	834	Joseph Franklin	3	45		79	4	24

PAY ROLL

WEEK ENDING – Aug. 16, 1924

DEPT.	KEY	NAME	HOURLY		BONUS		TOTAL	
24	505	George Ross	7	40			7	40
24	515	Warren Burke	1	74			1	74
24	521	James Harris	6	56	2	25	8	81
24	524	John Leslie	5	45			5	45
24	526	Edward Root	1	43		01	1	44
24	529	Walter Blair		60				60
24	548	Thomas Carroll	1	49			1	49
21	733	Charles Stanley		39				89

Form 65: Summary of weekly payrolls.

special burden rates of 2.5 per cent for standard development and 5 per cent for packing and shipping should be added, thus completing the summary.

Prepare job tickets from the foregoing payroll data for:

Date	Department	Key number	Name
Aug. 4, 1924	21	793	J. Bernard
Aug. 1, 1924	21	775	R. Martin

Make proper entries on the statement of completed piecework jobs and bonus earned (page 124, Form 25) and on the employee's weekly pay record (page 124, Form 25) for key nos. 793, 806, and 834.

Journal and Ledger Work

In practice entries and postings would be prepared at the end of the month for the separate totals of all the material, labor, and burden costs, for all jobs. But to enable the student to trace individual manufacturing orders through the books, the amounts used here are the totals of the specific orders for which the detailed cost items have already been gathered. In other words the amounts for these few orders are treated as if they were the totals for the month.

The entries to be made here therefore are, in general: (1) to charge to the proper goods in process accounts the amounts for material, labor, and burden shown on the order sheets; (2) to clear these out of the goods in process accounts, into Finished Parts account if they are parts, or into General Ledger Control in the case of a completed assembly order ready for shipment to a customer.

Prepare the necessary journal entries to record the foregoing information on the books and post them to the factory ledger, assuming that the factory ledger accounts showed the following beginning balances:

Purchased Parts	$4,820.00	
Magnet Wire	2,531.68	
Finished Parts	9,675.42	
Payroll		
Goods in Process, Assembly	9,252.60	
Parts	6,428.62	
Department 17 Overhead	4,256.80	
Department 21 Overhead	2,975.40	
Department 24 Overhead	3,523.27	
Standard Development	2,267.32	
Shipping and Packing Costs	1,148.21	
Loss and Gain on Factory Order	1,096.80	
General Ledger Control		$47,976.12

On completion of order A-64321 it was charged to the sales department at the standard rate for this type of motor, or $22.25 per motor.

The standard development cost was 2.5 per cent and the packing and shipping costs were 5 per cent of the total factory cost.

XVIII

NEW HALL CHEMICAL COMPANY

A Case in Process Costs

Manufacturing Processes

The New Hall Chemical Company is engaged in the manufacture of a considerable number of products, there being several departments; one of these departments makes commercial alum, known technically as aluminum sulphate. The principal ingredients are two: bauxite or aluminum oxide and oil of vitriol or sulphuric acid, the latter being produced in another department of the plant. The process is described here.

The basic chemical equation is

$$Al_2O_3 + 3H_2SO_4 = Al_2(SO_4)_3 + 3H_2O.$$

Aluminum oxide is received in chunks and is broken into small particles in a grinding machine before it is mixed with oil of vitriol, at a concentration or strength of 40° Baumé. Aluminum oxide, commonly known as bauxite, is obtained chiefly from North and South America and France. Alum is made in standard size batches, 7,600 lb. of sulphuric acid being mixed with 4,300 lb. of the ground bauxite. A batch is agitated by power in a mixing tank for 4 hr., during the last 3 hr. of which it is also cooked; for this purpose exhaust steam from the company's own power plant is used. The alum is then in solution, and the batch is filtered to remove all dirt and foreign matter, the filtering process taking 2 hr. The solution is then boiled in finishing kettles until one-half of the water has evaporated, a process requiring from 8 to 12 hr., depending on atmospheric conditions. The condensed solution is run off into steel pans about 8 by 16 ft. in size, where it crystalizes into a solid mass about 3 in. thick. It requires 24 hr. for the batch to harden, at the end of which time it is cracked by pounding it with tampers. Large chunks of alum are loaded on wheelbarrows, wheeled to a hopper, and dumped into a grinding machine similar to the one used to grind bauxite, but the alum is not ground so finely.

When it comes out of the grinding machine, the alum is usually put into storage in bulk. When required for shipment it is packed in 200-lb. jute bags or 450-lb. barrels, all of which are lined with heavy wrapping paper. The alum may be shipped directly to customers but is usually first placed in stock.

The mud left in the filter cloth is washed; the water drained off is used to dilute the oil of vitriol for future batches from 50 to 40° Baumé, and the mud is thrown away.

Material Costs

Bauxite is purchased in large quantities; it is unloaded in the open and is transferred to small storerooms located in the process building, these stores being kept filled to capacity. The company owns both a track scale and a wagon scale; on these the materials are weighed when transferred to process. All bins in the storeroom are of the same size, so the quantity of bauxite on hand may at any time be readily determined, thus providing a check upon the foreman's daily reports.

All materials received must be reported to the general office by the receiving department; no invoices are paid unless the quantities received correspond with the purchase order and the invoice, after all adjustments have been made. The receiving clerk is supplied with a copy of every purchase order, showing the quantity and quality of materials ordered, and the cost when that is known. The materials ledger is ruled in six double columns, to provide a complete record of purchases and consumption for a period of six months. The invoice cost of the materials, inward freight, containers, duties, insurance, handling charges, and any other items of expense which are directly chargeable to the cost of raw materials are transferred to the debit column of the Raw Materials account. In the case of sulphuric acid, which loses value through evaporation, the actual loss which occurs between the time when it is received and when it is used must be included in the cost of the material. If incoming containers are salvaged or returned to the vendor, the amount received is credited to the account to which they were originally charged.

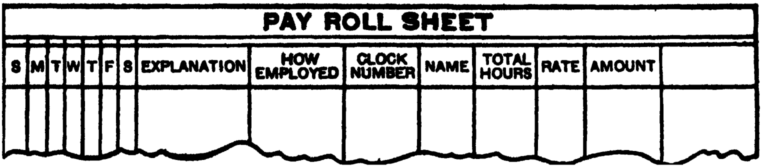
The foreman of each department reports daily to the works office the quantity put into process. These reports are summarized weekly and the summary is sent to the purchasing department to keep the purchasing agent informed on the trend of consumption. In a rising market these reports assist him in determining whether or not to order before the minimum quantity of material has been reached. The monthly reports of consumption are made either from the daily report of the foremen or from a physical inventory. The monthly reports show the opening inventory, purchases, consumption, sales, adjustments, losses, and closing inventories. This report is often based on estimates, since it is impossible to secure accurate figures when materials are handled in large quantities or stored in large piles in the open. Materials handled in small quantities are easily and accurately accounted for. The opening inventories, purchases, and sales are each month tied in with the general books and reconciled, as far as possible, with the Raw Material accounts.

Materials are charged to manufacturing at the end of each month on an average cost basis. This average rate is determined after the works office has made its monthly report to the general offices of the quantity of materials consumed and the losses known to have been sustained from evaporation or other causes.

Labor

When the entire plant is operated at capacity, 225 men are employed, not including foremen, office employees and salaried officers, and research staff; during slack seasons the payroll has been as small as 165 men. Manufacturing operations require comparatively little labor, because many processes are run continuously with mechanical equipment. The handling of raw materials and finished products requires the largest proportion of direct labor; approximately 95 per cent of the labor of the service departments is employed in maintenance or plant construction. The alum department alone employs normally about 25 men.

Every laborer is required to punch a time clock whenever he enters or leaves the plant. The number of hours each man has worked, obtained from the time clock ribbon, is entered on a payroll sheet, which is headed as follows:



PAY ROLL SHEET

S	M	T	W	T	F	S	EXPLANATION	HOW EMPLOYED	CLOCK NUMBER	NAME	TOTAL HOURS	RATE	AMOUNT	

Form 66: Payroll sheet.

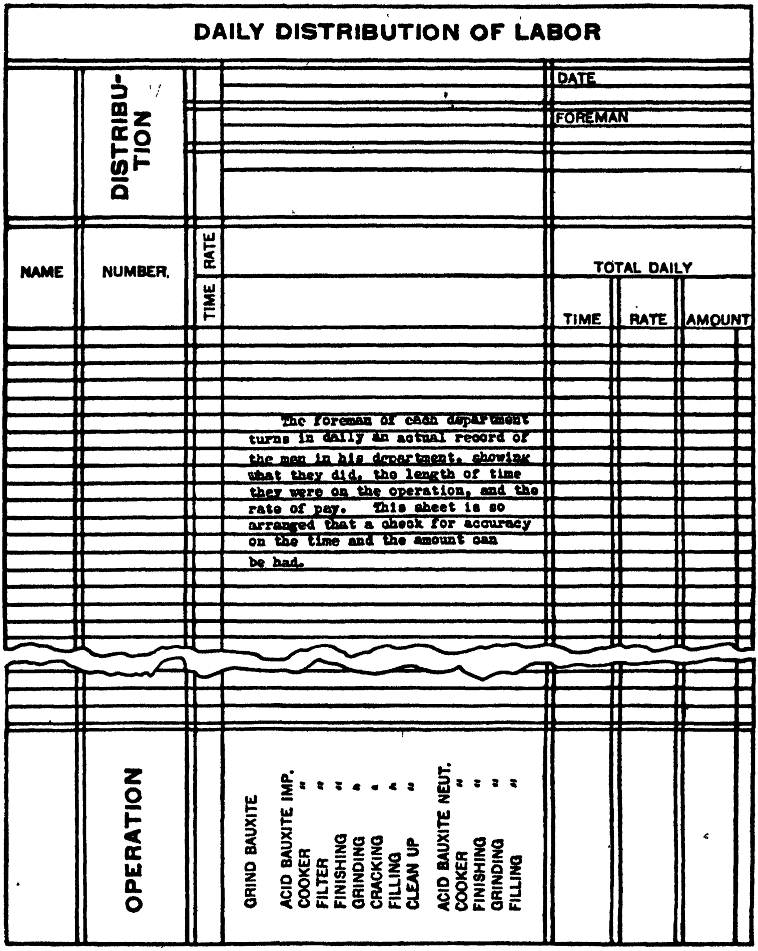
At the end of the week the hours for each man are extended and multiplied by his rate to obtain the total amount of wages for the week. A carbon copy of this payroll, excluding the columns for days of the week is sent to the general offices to serve as a notification to the cashier of the amount of money to be paid and as a record for use by the auditing department.

The foreman sends to the accounting department of the works office a daily record of the work of the men, showing processes worked on, time spent on each, and hourly rate. (Form 67.) In the manufacture of alum the processes are classified, for this purpose, as follows: Grinding bauxite, mixing bauxite and sulphuric acid, cooking, filtering, evaporating, cracking, grinding, filling bags or barrels, and cleaning up. The foreman's time is not included in this daily report, because his work is entirely supervisory.

A check on the accuracy of the daily reports, for time and amount, is obtained by cross-totaling and comparing with the time clock record. The daily reports are summarized, by operations, on monthly sheets (Form 68) which have a column for each type of work performed; the monthly labor cost of any operation may then be obtained by adding the column in which that operation is summarized. The monthly summary is authority for a journal entry crediting payroll and debiting the accounts for each operation; debits to payroll are made weekly from the cashbook, on the basis of the weekly clock cards as summarized on the payroll sheet.

Overhead

The expenditures of the New Hall Company in the manufacture of alum are in the following proportions: material 52 per cent, labor 8 per cent, power 14 per cent, supplies 3 per cent, repairs 8 per cent, overhead 15 per cent. The company considers power, supplies, and repairs in the same class with productive labor, because they may be charged directly to a department; these costs as a group are called "conversion costs" on the cost sheet. Manufacturing account is debited monthly with the amount of each of these items; any expenses not used directly on productive processes are charged to overhead.



DAILY DISTRIBUTION OF LABOR

DISTRIBUTION

DATE

FOREMAN

NAME

NUMBER

RATE

TIME

TOTAL DAILY

TIME

RATE

AMOUNT

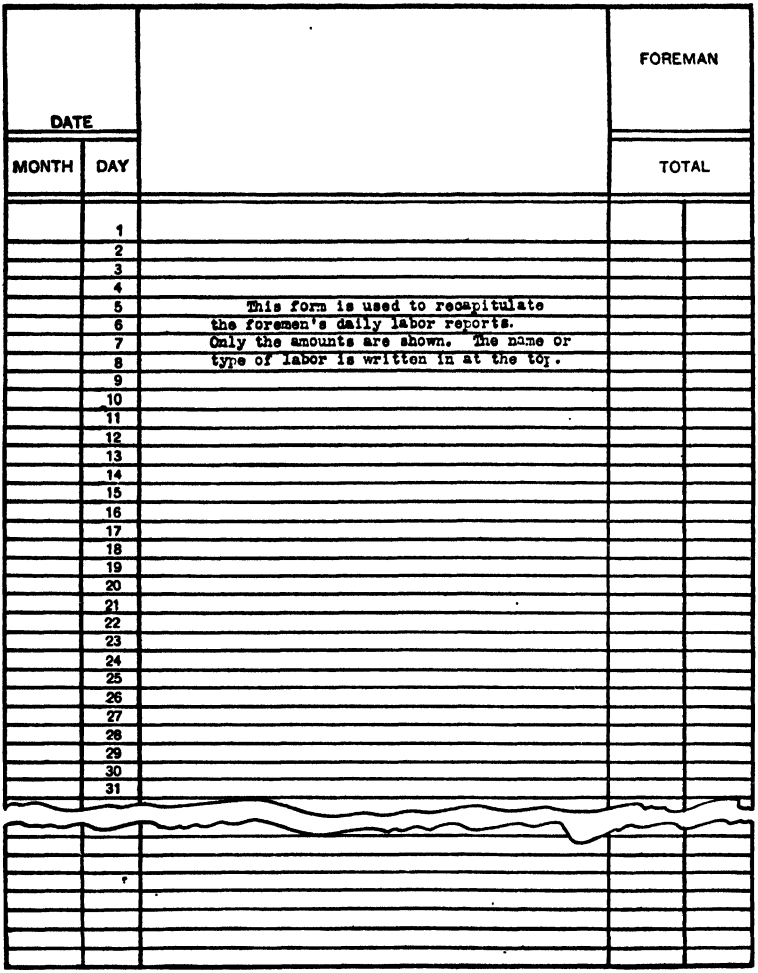
The foreman of each department turns in daily an actual record of the men in his department, showing what they did, the length of time they were on the operation, and the rate of pay. This sheet is so arranged that a check for accuracy on the time and the amount can be had.

OPERATION

GRIND BAUXITE
ACID BAUXITE IMP.
COOKER
FILTER
FINISHING
GRINDING
CRACKING
FILLING
CLEAN UP
ACID BAUXITE NEUT.
COOKER
FINISHING
GRINDING
FILLING

Form 67: Daily distribution of labor.

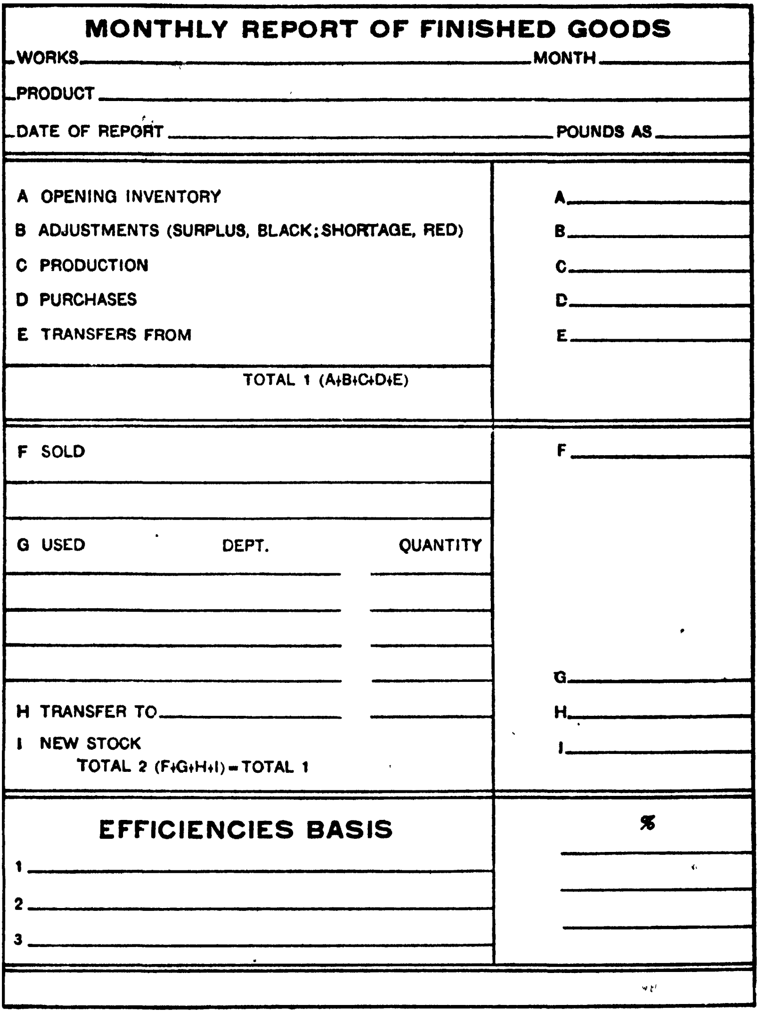
Overhead expenses, which are 15 per cent of the manufacturing costs, include taxes, insurance, depreciation, works administration, and laboratory and general expenses. Works administration includes all costs incidental to the works office; general expense includes the overhead of service departments, indirect labor not chargeable to repairs and plant construction, trucking and teaming and other miscellaneous expenses, including a share of the general plant administration. The totals of the various components of overhead are charged to



DATE			FOREMAN	
MONTH	DAY		TOTAL	
	1			
	2			
	3			
	4			
	5	This form is used to recapitulate		
	6	the foremen's daily labor reports.		
	7	Only the amounts are shown. The name or		
	8	type of labor is written in at the top.		
	9			
	10			
	11			
	12			
	13			
	14			
	15			
	16			
	17			
	18			
	19			
	20			
	21			
	22			
	23			
	24			
	25			
	26			
	27			
	28			
	29			
	30			
	31			

Form 68: Monthly labor summary.

manufacturing monthly, by the aid of a burden distribution sheet. Only in the case of research is there any exception, research being charged to surplus. The New Hall Company maintains the following shops: blacksmith, carpenter, electrician, mason, machine, pipe, plumber, and paint. Only a small percentage of the labor of these shops is not definitely chargeable to repairs or plant construction. When the payroll is prepared, it is classified by departments in order that the total amount of wages paid to employees in any department may be known.



MONTHLY REPORT OF FINISHED GOODS

WORKS ______ MONTH ______

PRODUCT ______

DATE OF REPORT ______ POUNDS AS ______

A OPENING INVENTORY	A ______
B ADJUSTMENTS (SURPLUS, BLACK; SHORTAGE, RED)	B ______
C PRODUCTION	C ______
D PURCHASES	D ______
E TRANSFERS FROM	E ______
TOTAL 1 (A+B+C+D+E)	
F SOLD	F ______
G USED DEPT. QUANTITY	
	G ______
H TRANSFER TO ______	H ______
I NEW STOCK	I ______
TOTAL 2 (F+G+H+I) = TOTAL 1	

EFFICIENCIES BASIS	%
1 ______	______
2 ______	______
3 ______	______

Form 69: Monthly production report.

The amount of wages chargeable to maintenance and plant construction is credited to the shop accounts, and the balance, if any, is added to the overhead of the shops, which is charged to the manufacturing departments through general expense.

Costs of Operations for the Month of October, 1927

	Cost per net ton	Total	Total cost for the month	Cost per net ton	Percentage of cost per ton	Standard percentage of cost	Variation from standard
Materials used: Pounds / Net Tons							
Bauxite 2,789,800 1,394.90	$ 20	$27,898					
Oil Vitriol 7,550,000 3,775	10	37,750					
Sulphide Liquor 85,520 42.76	50	2,138					
5,000 Net Tons Produced			$67,786	$13.5572	53.38+	52	+1.38
Conversion Costs							
Labor:							
Operating Labor	6,000						
Grinding Labor	2,500						
Clean-up Labor	150						
Miscellaneous Operating Labor	700						
Salaries	600						
Yard Team	15						
		9,965		1.993	7.85−	8.	− .15
Power:							
Tractor 1	300						
Tractor 2	10						
Steam	12,000						
Electric Power	5,000						
Air	750						
Light	10						
Water	400						
		18,470		3.694	14.55−	14.	+ .55
Supplies:							
Filter Cloth	3,000						
Direct Purchased Supplies	150						
Transfers	10						
Storehouse Expense	300						
		3,460		.692	2.72−	3.	− .28
Repairs:							
Repairs	10,000	10,000					
			41,895	2.000	7.87+	8.	− .13
Overhead							
To Taxes:							
City	900						
State	200						
Insurance:							
Fire	750						
Liability	350						
Use Occupancy	105						
Depreciation	3,500						
General Factory Expense	5,500						
*Laboratory 600							
Works Office	6,000						
		17,305	17,305	3.461	13.63−	15.	−1.37
Total charged to production of alum			126,986				
Total Net Tons Produced = 5,000 Cost per Net Ton				25.3972	100.00	100.00	0.00

* Research is charged to Surplus.

Form 70: Monthly statement of unit costs.

The cost accounting records are kept in the general office. Each month the works office reports to the accounting department of the general office the quantity of product manufactured during the month. This report (Form 69) is summarized from daily records of production.

From other reports prepared by the works office the accounting department at the general office prepares a monthly cost sheet to show in detail the costs of the product for the month previous, classified into three main groups, namely, materials, conversion costs, and overhead. A sample of this report is shown as Form 70, which shows the monthly quantities and amounts in the first three columns; the other columns show the unit costs for the month as compared with standard unit costs.

Ledger Accounts

For each main division of the works there is a subsidiary ledger, containing the expense and inventory accounts, and controlled from the general ledger. The trial balance for the alum department ledger is shown below; it will be seen that labor and expenses are here not subdivided to the same extent as in the cost sheet, Form 70; the further analysis in the latter report is prepared from the detailed reports elsewhere referred to. All accrued and prepaid accounts were kept in the general ledger, only the corresponding expense accounts being kept in the factory ledgers.

NEW HALL CHEMICAL COMPANY
TRIAL BALANCE—ALUM DEPARTMENT LEDGER, MAY 1, 1928

Bauxite	$ 97,640
Oil Vitriol in Alum Department	115,250
Sulphide Liquor	5,486
Materials in Process	2,356
Labor and Burden in Process	1,184
Operating Labor	25,000
Grinding Labor	10,000
Miscellaneous Operating Labor*	4,750
Salaries, Superintendence	2,500
Power Plant Costs†	72,648
Supplies, General‡	12,825
Packing	11,562
Storehouse Expense	1,310
Repairs and Maintenance	39,735
Taxes	4,350
Insurance	4,500
Depreciation	14,000
General Factory Expense	23,100

Laboratory	2,600	
Works Office Expense	23,500	
Returnable Containers	250	
Finished Alum, Bulk	130,136	
Packed	30,722	
Payroll Distributed		$ 39,750
Expense Distributed		212,630
Labor and Overhead Adjustment	415	
Net Balance as per Alum Department Control Account		383,439
	$635,819	$635,819

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* Includes Clean-up Labor, Yard-team, Tractors I and II.
† Includes Steam, Electric Power, Air, Light, Water.
‡ Includes Filter Cloth, Direct Purchased Supplies.

Problem

Open ledger accounts for the alum department ledger, as shown in the foregoing trial balance, and post in them the amounts given below, representing the summary totals for operations for the month of May, 1928. Show, also, those general ledger accounts which are affected by these operations, namely, Alum Department Control, Sales, Cost of Goods Sold, Accounts Receivable, Accounts Payable, Acid Department Control, Taxes Prepaid, and Cash, with such postings as need to be made in them for the transactions here given. Take a trial balance of the alum department ledger, and prepare the May operating statements for the department, in forms similar to those contained in Forms 69 and 70.

PURCHASES OF MONTH, AS SHOWN BY PURCHASE BOOK

Bauxite, 3,000,000 lb. @ $20 per ton	$30,000
Supplies, General	3,000
Packing	2,500
Repair Materials	2,000

In connection with these purchases, returnable containers were received, for which total charges of $115.30 were made to the alum department. During the period containers were returned to vendors to the value of $138.50, and credits obtained for that amount. Since it was expected that all charges for containers would eventually be settled by returning the containers, no entry was made for them in the monthly cost sheets.

The oil of vitriol received in the alum department from the department in which it was manufactured amounted to $38,500; the sulphide liquor obtained from filtering the mud was 88,000 lb., which, valued at the standard rate used for this purpose of $50 per ton, amounted to $2,200. This credit to Materials in Process was supposed to cover the value of materials only, and not to include anything for labor and burden of the previous processing.

The cashbook and voucher register showed the following items as being charged to the alum department:

Payroll:	
Operating Labor	$ 6,500
Grinding Labor	2,700
Miscellaneous Operating Labor	1,150
Salaries, Superintendence	850
Power Plant Costs	19,200
Storehouse Expense	325
Repairs and Maintenance Labor and Expense	8,800
General Factory Expense	5,800
Laboratory	700
Works Office Expense	5,900

Taxes for the year were prepaid during this month, the amount being $12,900. This calls for record only in the general ledger accounts. The laboratory charge of $700 was for research and therefore chargeable to Surplus.

Amounts were charged to the department through the alum journal as follows:

Taxes	$1,075
Insurance	1,100
Depreciation	3,500

The following materials were put into process during the month:

Bauxite	2,800,000 lb.	@ $20 per ton	$28,000
Oil vitriol	7,600,000 lb.	@ 10 per ton	38,000
Sulphide liquor	86,000 lb.	@ 50 per ton	2,150

The total expenses of the month, amounting to $54,050, and the total payroll of $10,350 were transferred to Labor and Burden in Process.

When the work finished during the month had been totaled, it was found that Materials in Process, $65,996, and Labor and Burden in Process, $62,064, were transferred to Finished Goods; of these amounts $100,810 went to Finished Alum, Bulk, and $27,250 to Finished Alum, Packed. The inventory at the end of the month of Finished Alum, Bulk was $127,136, and of Finished Alum, Packed, $31,400. Alum produced was 5,100 tons.

Sales of Alum during the month amounted to $140,300.

When the cost of operations form has been completed, it will be observed that the term "overhead" is not used here in its usual sense. Except for direct labor, all the conversion costs would ordinarily be called overhead. But under a system of process costs all these conversion costs are direct charges to the department; what they are doing is to segregate under the heading conversion costs all those expenses for which the department heads may be held responsible. Overhead, on the other hand, includes those fixed charges for which the foreman of the department has very much less, if any, responsibility.

XIX

COST REPORTS FOR EXECUTIVES

Cost Reports to Foremen

The policy of supplying cost data to foremen, in attempting to gain their more active and intelligent support for the plans of the management, is no longer in an experimental stage; it has been tried and has yielded dividends in many progressive plants. The statement that only 10 per cent of foremen do in fact get cost information[1] may be true, if all types and sizes of industry are taken into account; but if so, it only shows how much room there is for progress. It is safe to assert that the 10 per cent probably includes some of the most successful companies.

The whole idea of training foremen is just now receiving much attention. There has in the past been too great a tendency to regard the foreman as a practical man not interested in "paper work." This idea is no longer accepted; many foremen are obviously alert for every improvement, and many others who seem less so are willing to be shown, if approached in a reasonable and practical way. It is coming to be more clearly realized that the foreman is the executive who actually spends a large share of the company's money; either he gets a satisfactory return for these expenditures or else a satisfactory return is not obtained at all. He is the man who is constantly in touch with the workmen, shows them the short cuts, and organizes them efficiently if they are so organized. It is absurd to say that he is not interested in results; what he wants is results expressed in terms which he can understand and do something about.

The National Cash Register Company emphasizes, as a dominant note in training foremen, the reduction of cost and the elimination of waste in material, labor, and burden.[2] The

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[1] National Association of Cost Accountants, *Official Publication*, Vol. v, No. 18.

[2] *American Machinist*, July 1, 1926, pp. 1–4.

International Harvester Company states its primary objectives as maintenance of production, reduction of costs, and improvement of quality.[1] Obviously, these purposes cannot be fully accomplished except by informing the foremen as to the facts upon which they are supposed to improve.

How to Interest Foremen

The first requisite for success in presenting reports to foremen, or to any other executives, is to give them information about things which come within their jurisdiction and to exclude matters for which they are not responsible. The second need is to study the form of the reports with a view to putting the information in the plainest and most significant way. Too often attempts have been made to give the foremen the stereotyped form of income statement, including allocations of general administrative and selling expenses, sometimes including items for the upkeep of distant offices which he had never seen. It was not to be expected that he should show any great interest in such information. But reports dealing solely with his own department, or perhaps comparing his results with those of other departments, will always interest him if they can be set up in forms which he can readily understand. The third thing is to report to them immediately on matters upon which they are expected to act. It is useless to bring to their notice cases of excessive labor and material costs weeks after they have occurred; daily reports and weekly reports are the most appropriate and helpful records for foremen.

The foreman is responsible for the economical use of materials, labor, and burden in his department. The obvious things to present to him are figures showing how well he has succeeded in the discharge of his duties in these matters. If more materials have been used than the standard allowance, or if a longer time has been taken by workmen upon certain operations than had been determined to be necessary, he should be informed about it promptly and should have the exact figures, in order that he may take it up with the man concerned. The overhead of his department seems a little more remote to him, but it is all the more necessary that he should be led to understand the amount and significance of the fixed charges involved in the manufacturing facilities placed at his disposal. This is particularly true where the foreman has considerable authority to requisition for additional equipment. Cases are on record where foremen have entirely reversed their attitude upon learning about these matters; a foreman who previously had a chronic habit of demanding more and more equipment for his department began at once to ask for some of it to be moved away when he was shown the figures of costs involved and found that he was being judged largely upon those figures.

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[1] *American Machinist*, June 3, 1926, pp. 863–864.

Preparing for Reports

The best results from supplying reports to foremen are obtained if meetings or training courses are held in which the reports are discussed. Before any reports are submitted to them, they should be prepared to receive them in a series of talks which aim to explain the purposes of the proceeding, laying stress on the fact that the reports are not intended as complaints or criticisms but are prepared as helps to the foremen in effecting a better control of their departments, by letting them know exactly where they stand. These explanations will be especially useful prior to presenting figures of the departmental overhead. Some firms have even been able, by such educational methods, to interest their foremen in the prorating of general and selling overhead; here the central idea has been to indicate to the foreman his place in the general scheme and the degree of responsibility which rested upon him if a net profit was ultimately to be earned by the business. The foreman must produce at a certain manufacturing cost, it is argued, in order that the product may be able to carry a certain general and commercial overhead and still show a profit. But the advantages of so doing are much less obvious than those of reporting the departmental overhead for which the foreman is directly responsible. If this is kept within certain proper limits, that is the end of the foreman's responsibility, and the coordinating of this satisfactory manufacturing cost with satisfactory results in other departments, in order to secure a satisfactory profit, is a duty which falls upon the general management. If, therefore, general overhead figures are added, it should be explained to the foreman that these are designed to show him why a certain gross margin is necessary but in no way intended to hold him responsible for other departments.

Foremen's Bonuses for Expense Reduction

The strongest inducement of all, of course, is to pay the foreman a bonus in connection with attempts to reduce expenses. If expense reduction has become an urgent matter, requiring continuous pressure and attention, then it is sometimes found that the way is made easier by thus giving the foremen an incentive to cooperate with the management in this way. Several of the well-known systems, such as the Bedaux and the Manit systems, include foreman bonuses in their regular structure, and the idea can be added to almost any bonus scheme. In some cases where the emphasis has always been on such things as quality or low proportion of spoilage, especially if the foreman's bonus is related primarily to these things, it is sometimes hard to get his mind turned around to the point where he is ready to tackle aggressively the job of watching costs and reducing them. In such case the addition of a bonus to the basis of his compensation, or a change in an existing bonus to relate it to expense reduction, has sometimes helped in attaining the desired end.

Closer Control of Quality and Costs through Foremen

In an article under this title[1] Mr. George Marion Brown, President of the Certain-teed Products Company, described the very effective uses which that company had made of reports to foremen. Through these reports they have aimed to

1. Take an active part in effecting cost reduction.
2. Learn to manufacture with minimum stores quantities.
3. See that material formulae are adhered to regularly.
4. Maintain accurate check on material quantities.
5. Make daily man-hour and production reports.
6. Maintain physical orderliness in material stores.

So great a degree of accuracy has been brought about by carefulness in these matters that it was stated that physical inventories varied from book inventories only to an infinitesimal degree—one hundredth part of 1 per cent in one plant. It was believed that the reports paid for themselves many times over. Similar close attention was given to labor and to expenses.

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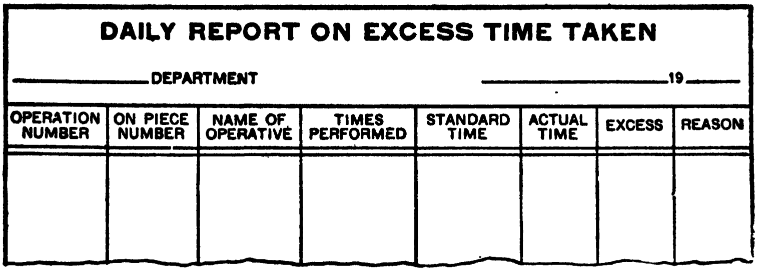
[1] See *Factory*, July, 1926, p. 37.

Some Examples of Reports for Foremen

As an example of that type of form which brings labor cost irregularities immediately to the attention of the foremen, Form 71 is presented.



DAILY REPORT ON EXCESS TIME TAKEN

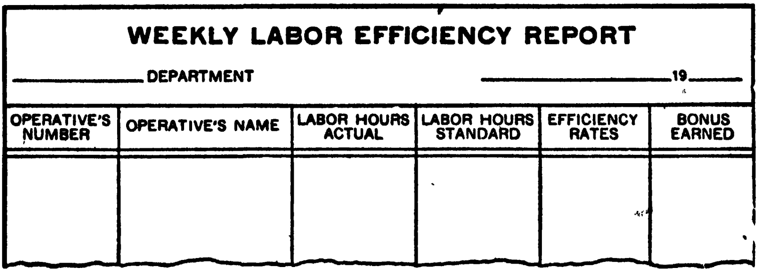
________ DEPARTMENT ________ 19____

OPERATION NUMBER	ON PIECE NUMBER	NAME OF OPERATIVE	TIMES PERFORMED	STANDARD TIME	ACTUAL TIME	EXCESS	REASON

Form 71: Daily report on excess time taken.

All operations which are found to be out of line are recorded on such a form; the foreman receives it within 24 hr. and can immediately make inquiries to ascertain the difficulties and apply the remedy. Sometimes this form of report is expressed in standard and actual dollars and cents cost of the operations, instead of in time, thus emphasizing the amount of loss involved on the operations listed.

Form 72 relates to the same topic but is a weekly report covering all men under the control of the foreman.



WEEKLY LABOR EFFICIENCY REPORT

________ DEPARTMENT ________ 19____

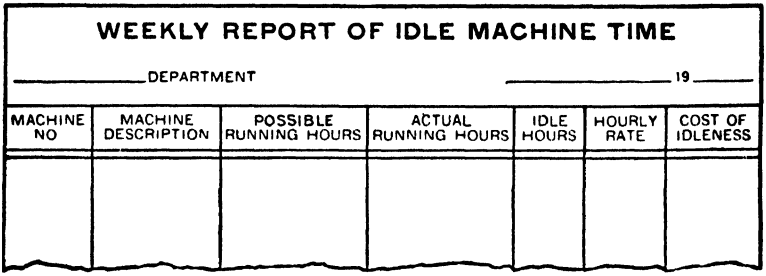
OPERATIVE'S NUMBER	OPERATIVE'S NAME	LABOR HOURS ACTUAL	LABOR HOURS STANDARD	EFFICIENCY RATES	BONUS EARNED

Form 72: Weekly labor efficiency report.

As with Form 71, it is assumed that standard times have been set for the various operations to be performed, with which actual time may be compared to indicate conditions.

Such a report may be modified to suit the particular wage system in use and the manufacturing conditions. If it is not possible to measure the output of the individual workman, the output of groups may be used as the unit on which to report.

Where machine work is the leading feature, idle machine time is one of the greatest causes of loss and therefore one of the things to be closely watched. Form 73 provides a weekly report for this purpose, the actual and standard running time of each machine being there shown, with the cost of the idle time.



WEEKLY REPORT OF IDLE MACHINE TIME

______DEPARTMENT ______19______

MACHINE NO	MACHINE DESCRIPTION	POSSIBLE RUNNING HOURS	ACTUAL RUNNING HOURS	IDLE HOURS	HOURLY RATE	COST OF IDLENESS

Form 73: Weekly report of idle machine time.

If the idleness is due to lack of business, the foreman, of course, is not responsible; but when activities are at or above normal, it is incumbent upon him to make the best possible use of his equipment, and this form will be of assistance to him for that purpose. Time lost through defective routing or through repairs will be carefully noted; and these reports will be valuable when the acquisition of additional machinery is being contemplated.

Department Operating Reports

One of the most common types of reports for foremen is the report of departmental operations, prepared daily or weekly, as may be required or found convenient. These reports summarize in plain terms the operations done in the department during the period. They show such things as:

1. Quantities of materials put into process.
2. Time taken in each of the various operations.
3. Time of running machines, if any.
4. Time, rates, and wages of operatives in the department.
5. Report on the condition of materials, if needed.
6. Order numbers on which the foregoing facts apply.

WASHER REPORT FOR 24 HOURS OF 192

Bleach No.	Rags		Bleach Gallons	Into Drainer No.	Washers				Time Report					
	Cars	Kind			No.	Time On	Time Off	Condition	Name	Occupation	Bleach Hours		Other Work Hours	Total Hours
											No. 1	No. 2		

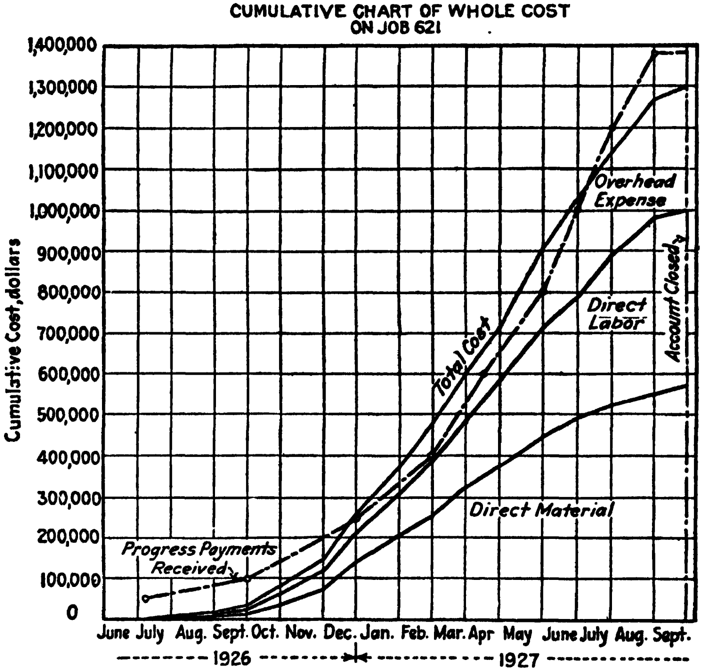
Form 74: Report of washer department.

The information gathered is in fact of two kinds: first, it gives full particulars about the amount of work done; and, second, it records the beginnings of cost information, which is afterwards used by the cost department in figuring costs of production of the finished article.

An example of such a departmental report is seen in Form 74, which is the form of report used in the department of a paper mill in which they wash the rags before breaking them up to use in paper making. The report covers a whole day of 24 hr.; from it the foreman could see next day whether or not his department was keeping up a satisfactory performance.

Graphic Chart on Progress of Job Costs

Where large construction jobs are in progress for a long time, it is important to keep track of them as clearly as possible.



Form 75: Chart of total job costs.

Form 75 is such a report in graphic form, presenting the costs of building a ship, extended over a period of 15 months. This particular chart probably would not be furnished to a foreman, since it not only shows the total costs, broken down into materials, labor, and overhead, but it also shows the payments received from the client, and therefore the profit. But similar charts to this, representing the progress of subdivisions of cost, such as the labor costs of one department, might well be prepared for a foreman; and it would be all the more useful if, with the line of actual costs, there could also be shown the line of estimated costs.

A Monthly Operating Statement

In the article previously referred to the statement was made that a monthly cost report to foremen, covering the operations of their departments, is a very effective way of reducing costs. Such a report will summarize material, labor, and overhead costs for the department, comparing them with standards whenever possible. In the case of the Certain-teed Products Company, a standard price was determined at which finished goods were turned over by manufacturing departments to the sales department, thus providing an opportunity for showing to foremen a profit or loss on their output, as compared with the standard. Before doing this, a share of general overhead was apportioned to the department to emphasize to the foremen the fact that, as stated above, these other charges had to be met before the company could make a profit, and thus indicating the necessity for his keeping his part of the costs within bounds.

Other Useful Reports

Every plant should single out those matters to which it is especially desired that the foremen give attention and should design their reports to inform him on those matters. Daily or weekly reports on spoiled work are often desirable; a foreman may judge from these that closer inspection is necessary in the earlier stages of manufacture, thus avoiding the subsequent application of labor and burden to defective materials. Spoilage by individual workmen will also receive attention, and in some cases a statement of the cost of reclaiming spoiled work has been effective. Where foremen have stores under their control, they should give attention to the checking of the quantities on hand against the perpetual inventory records, following up the differences with a view to ascertaining their causes. Supplementary to Form 72 it is sometimes advisable for the foreman to have a progress record for each man indicating his weekly progress in the matter of earning or not earning a bonus. This is especially useful in enabling a foreman to judge whether new men are progressing sufficiently to justify their retention in the department or whether it seems desirable to transfer them to other work.

In some cases good results have been accomplished by furnishing the foreman with reports on labor turnover, with some figures indicating the costs of these changes. Where the foreman is a considerable factor in taking on or laying off men, he should be kept informed of the results of his supervision.

Collecting Cost Data

While the supplying of cost reports to foremen is being referred to, mention should also be made of the assistance which they can and should give to the detailed collection of cost data in their departments. Unless they take an interest in this work and lend their influence to its being carefully done, inaccuracies are likely to arise which only they can prevent. An additional stimulus is given to the foreman when he is to receive summary reports derived from the detailed records which are constantly going through his department. A foreman will frequently question some of the figures in these reports; and if he discovers that errors have arisen through carelessness in his own department, he will realize the necessity for attention to these matters.

Reports to General Executives

The reports in which the directors and general officers are principally interested are the monthly balance sheet and income statement. The cost department will make its contribution to these by keeping book inventories up to date, checking them as closely as possible with the actual inventories on hand; the summarized cost figures will be used to build up the cost of goods sold and the expense items in the income statement. The general executives will doubtless also wish to receive summary statistics of production, sales, shipments, and collections; all of these figures will be so much the more useful and expressive if they can be compared with budget figures previously determined.

The works manager is probably interested in all the reports just named; if, as often happens, he is one of the vice presidents, he will automatically receive them. But he will also receive further information consisting essentially of a somewhat condensed form of the reports submitted to foremen for the departments, summarized into general reports for the whole works. It should be arranged for the foremen to receive their information promptly and in detail; they would then be prepared to discuss matters with the works manager when he had received his summary reports and found it necessary to investigate certain items further. In this way the works manager will be able to maintain effective supervision over the handling and cost of materials and labor, as well as over the volume of output.

Summary of Costs and Variations

One of the most useful reports a plant superintendent or general manager can have is one in which the actual costs are compared with the standard costs, and the variations are analyzed according to their causes. Here the results of each operating department are summarized on one line. The actual costs of the department are given in the first money column; in the second column are given the amounts absorbed by production. These figures are obtained by multiplying the number of hours of work, or other units, by the standard burden rate, thus giving the amounts charged to production at the standard rates. The remaining columns give the reasons for the variations and the amounts coming under each reason.

Adapting Reports to the Executives

Every works manager has his own ideas as to the particular items which should go into these reports and the form in which they should be rendered. For the most part, the cost department will do its duty by conforming to these requirements. There is, however, a good deal of variation among cost accountants in the extent to which they show intelligence in directing attention to unusual circumstances and vital developments.

Where the works are divided into distinct departments, the manager will expect to receive a fairly complete cost statement for each department each month. There may be some system for marking items calling for special attention. Sometimes the manager receives a summary report of his

COST AND VARIATION STATEMENT

Period Ending 19

	Actual Costs	Standard Estimate Costs Absorbed by Production	Net Costs Variations	Analysis of Net Variation According to Cause				
				Estimates and Methods	Volume of Output	Production Efficiency	Amount of Labor and Variable Expense	Amount of Fixed Expense
Operating:								
General Manufacturing Expense								
General Printing and Stamping.								
Printing Production...........								
Stamping Production..........								
Bordering...................								
Hand Coloring...............								
Finishing and Boxing..........								
Storage and Handling.........								
Filling Orders................								
Shipping....................								
Total Operating Variations...								
Outside Work:								
Outside Printing.............								
Outside Stamping.............								
Outside Offset...............								
Total Outside Work Variations								
Materials:								
Paper......................								
Boxes......................								
Envelopes..................								
Ribbons and Sundries.........								
Total Material Variations....								
Grand Totals............								

Form 76: Cost and variation report.

own, and in addition a copy of the reports to foremen, to which he can refer for more detailed information if he so desires.

In some cases it will be found that reports which are prepared at the requirement of the government, such as reports of individual earnings of employees, can frequently be made, with a little modification, to serve the purposes of reports to the management. Unless this matter is watched, there will arise a good deal of unnecessary duplication; every new government requirement will be made the occasion for the compilation of a special report, although it might very well be combined with something already existing within the plant. The yearly earnings record on page 124 would give information both for tax and for management purposes.

Reports on Plant and Maintenance

The condition of the manufacturing plant and equipment will be a matter of interest to the works manager. It is now a common custom to budget maintenance and repairs and to endeavor, by means of regular and systematic inspection, to anticipate and prevent breakdowns. In this way losses due to interruption of production can largely be avoided; it is further claimed that the actual expense of repairs and maintenance may be reduced by this policy. A procedure of this sort is particularly desirable where human safety is in question, as in the case of railroads. Regular reports should reach the works manager covering the extent of the repairs and maintenance actually done, and also conveying, by means of an engineering survey, information as to the present condition of the plant. This matter is more fully dealt with in Chapter XIII.

While the cost department should prepare adequate, intelligent, and economical reports, it is permissible to say that some executives could with advantage learn a little better the art of getting information from written reports. Those executives who have risen in the shops have a natural tendency to get their information by using their own eyes around the plant; the ability to do this is one of the most necessary attributes of a good manager. There are, however, elements which do not appear on the surface, especially when the plant has grown beyond the point where it can all be observed in a few minutes. In these conditions it is part of the education of the executive to learn to grasp information submitted to him in written reports from subordinates.

Indexes of Performance

The more complex a business becomes, the more will the busy executive desire to condense the reports which come to him into a few clear and simple elements; the cost department should in such cases be able to devise a form of report which will consist largely of a few main figures reflecting the key aspects of the business. Sometimes each of these figures will represent a single fact, such as the quantity of raw materials converted, the number of tons of coal consumed in the power house, the number of full days of direct labor, or the number of packages sent out from the shipping floor. When a number of products is being made from a single raw material, as in the conversion of live animals into meats and by-products, a composite index representing the total yield is useful, showing, say, the pounds of product per 100 lb. or per bushel of materials used; when the product consists of a number of different sizes of the same article, as with automobile tires, it is convenient to express the output in terms of a standard tire, which may be an average size or perhaps the most popular size. A still further statistical development occurs when several of the foregoing factors are combined into a composite index which may be regarded as presenting a broad picture of the industry. In creating such an index it is well to bear in mind the precise conditions which it is intended to reflect, especially whether it represents volume of business or efficiency. For the former purpose a composite of the number of full days of direct labor, the quantity of raw materials converted, and the shipments of completed product might be considered to form a reliable index; for the latter purpose, on the other hand, an average of the output in units per man, of the waste or scrap, of spoiled work, and of material used per unit of product could be used. Obviously the factors which are significant will vary in different industries, but the main thing to bear in mind is to select those factors which will produce the clearest and most comprehensive picture of a varied group of conditions.

Graphs as Accounting Reports

The use of graphs for reporting accounting and statistical data is still more effective than the use of composite indexes. They convey information so clearly, and the general movements of a long period of time can be seen so well in a moment, that practically all businesses of any size use them. In some companies the walls of the directors' room are covered with graphs of various types which are kept up to date by the accounting or statistical department; at any time, therefore, the main facts on any matter which may be under discussion may be referred to by all the directors in a moment. The cost and general accounting department should, therefore, be alert to use charts in presenting data to the executives; they take no more time to construct than does the preparation of figures; and whereas many men have difficulty in following a series of figures, the significance of a chart is very easily grasped.

Series of figures such as weekly or monthly output can best be represented by a line chart, which may be either simple or cumulative; in the latter case the figures for each week or month are added to the previous total, so that the line constantly rises to give the total at the end of the year. Comparisons of previous periods are rendered particularly easy by the use of this type of chart. For showing the subdivisions of a total, such as the percentages of the various items of expense to the net sales, a pie chart or circle divided into segments is very effective; by it the relative importance of the various elements going to make up the total is very clearly displayed.

Bank Account Summary and Analysis

An interesting and entirely different form of report is that used by banks for the study of a customer's account. From Form 77 the general results of an account analysis may be seen over an entire series of 12 months. First are given the various items of costs for handling deposits, checks, and so on, the total of these appearing on line 13. Next is given the income from the account, calculated on the assumption that the average loanable funds can be invested to yield 5 per cent to the bank. The difference between line 13 and line 17 gives the result in profit or loss on line 18. It will be seen that in most months this particular account, which was an actual instance, showed a loss, arising chiefly from the number of items handled, the interest paid to the customer, and the charge (line 10) made for having to keep a reserve of 20 per cent of loans made to the customer. Thus in January the bank loaned the customer $6,000 (line 22); the bank assumes that it must keep on hand 20 per cent of this available for the customer's use, or $1,200; 5 per cent of this would be $60 per annum or $5 per month, as

ANALYSIS OF ACCOUNT ____________ OFFICE Name of Customer ____________

MONTH AND YEAR ________ 19 ____	Summary Years				Jan		Feb.		Mar.		Apr		May		June		July		Aug		Sept.		Oct.		Nov.		Dec.		SUMMARY	
CHECKING ACCOUNT COSTS	$			¢	$	¢	$	¢	$	¢	$	¢	$	¢	$	¢	$	¢	$	¢	$	¢	$	¢	$	¢	$	¢	$	¢
1 Deposited Items, (Dep. Ticket, Cash, Checks) at 2 cents. (Exclude Chs on us).						58		74		94	1	32	1	80	1	58	1	44	1	52	1	34	1	22	1	24		96	1	22
2. Checks paid at 5 cents.					1	40	2	25	1	05	1	50	2	95	1	90	1	75	2	50	1	80	2	45	2	25	2	30	2	01
3 Overhead (Executive) at ½% per year on Average Collected Balance (No. 1) (no entry under $1)					1	59	1	17	1	29		58		96		96	1			42		75	1	33	1	87	1	92	1	15
4. Interest Paid.					3	81	1	89	2	42		17	1	03		0		62		0		0		0	1	90	1	95	1	15
5. Exchange Paid.																														
6. Special Check Book Expense.																	1	50												13
7. Payroll Expense.																														
8. Messenger Expense.																														
9. Other Tellers' Expense, Counting of bills, Coin, etc.																														
10. Charge at 5% per annum for required free balance of 20% of average loan.					5		5		5		5		4	92	4	84	4	94	4	75	4	75		0		0		0	3	67
11. Interest Charge on Overdrafts at 6% (No. 1)																														
12. Any other Expense, Tel. Calls, etc.																														
13. TOTAL COSTS (Items 1 to 12).					12	38	11	05	10	70	8	57	11	66	9	28	11	15	9	19	8	64	5		7	26	7	13	9	33
CHECKING ACCOUNT INCOME																														
14. Earnings of Loanable Funds at 5 % (No. 2).					12	79	9	37	10	50	4	50	7	50	6	66	6	99	3		5	33	9	32	13	32	13	65	8	58
15. Service Charge received at $1.00 per month.																														
16 Other Income																														
17. TOTAL INCOME (Items 14 to 16).					12	79	9	37	10	50	4	50	7	50	6	66	6	99	3		5	33	9	32	13	32	13	65	8	58
18. RESULT of Analysis, Diff between 17 & 13 Profit in Black—Loss in Red.						41	1	68*		20*	4	07*	4	16*	2	62*	4	16*	6	19*	3	31*	4	32	6	06	6	52		75*
19. Amount Charged to Account.																														
20. Number of Deposited Items, Dep. Tickets, Cash, Checks. (Exclude Chs. on us).						29		37		47		66		90		79		72		76		67		61		62		48		61
21. Number of checks paid.						28		45		21		30		59		38		35		50		36		49		45		46		40
22. Average Line of Credit used during month.					$	6.0	$	6.0	$	6.0	$	6.0	$	5.9	$	5.8	$	5.8	$	5.7	$	5.7	$	5.7	$	5.6	$	5.6		5.8
23. Average Collected Loanable Daily Balance.						3.3		2.5		2.8		1.2		2.0		2.0		2.1		.9		1.6		2.8		4.0		4.1		2.5
*Losses																														

Form 77: Account analysis for a year.

shown on line 10. In general, therefore, this was not a profitable account, in spite of its having an apparently satisfactory daily balance (line 23). As a result of this analysis the bank practically discontinued paying interest on this account between the months of June and October.

Relations of Reports to Financial Books

There is one thing that the student should clearly understand about the preparation of reports for executive uses, and that is that they are not always or necessarily prepared along the same lines or according to the same rules as apply to the keeping of the financial records. For this latter purpose a body of rules, known generally as "principles of accounting," has been developed and is a very useful guide in making up the balance sheet and the income statement. In fact any balance sheet not prepared according to these rules is almost certain to mislead readers who expect, and have a right to expect, that it has been prepared according to the rules. To this end, therefore, it is essential that any entries in the financial accounts shall be in harmony with the rules.

But when it comes to the preparation of reports and statistics outside the scope of the financial accounts, which are to have nothing to do with the balance sheet but are compiled solely to assist the management in viewing their problems more correctly and clearly, then these reports are not necessarily bound by the principles of accounting. Any presentation which makes the reports more helpful is justified, the only proviso being that, if they deal with matters also handled in the accounts, care must be taken not to become confused between two different presentations, as there is danger of doing.

As an example of what is meant, consider the making of profit and loss statements by classes of goods, for the purpose of showing their relative profitableness or the relative ability of different salesmen handling the lines. It may be practically impossible to get the actual costs of these lines as they are sold, but it may be a fairly simple matter to set up standard costs from which to compute the cost of goods sold. If the actual production costs vary somewhat from these standards, it is of no consequence here, and there is no need to explain the variations, because it is not manufacturing results but selling results which are being investigated.

Conclusions

It has constantly been emphasized that cost data are valuable only when used, and it is through presentation to executives that they are likely to be used. It is therefore worth while to give a good deal of attention to this subject, and to make somewhat frequent attempts to improve the organization and presentation of the cost reports. Since different executives make use of different approaches to their jobs, no standard form will apply to all, and this it is which makes it desirable to experiment to find the types of reports which will strike any given executives most forcibly. For this reason no further report forms will be suggested in this chapter, but in other parts of the book various forms which are actually used in different companies are given as illustrations of specific aspects of cost work.[1]

QUESTIONS AND PROBLEMS

1. Is it in your opinion worth while to supply cost reports to foremen? If you think it is, what benefits would you expect to secure from it? If you think not, what objections do you have to the practice?
2. Upon what lines should cost reports for foremen or for any other executives be planned?
3. Name some of the topics which you think should be reported to foremen, stating what use you think he would make of each.
4. Two shops in a plant each employed 100 men, but in one the work was mostly hand labor and in the other it was machine labor. What would be likely to be the foreman's principal concern in each case, and how might he be helped by reports?
5. What is meant by an index of efficiency? Who would use it and what would it be likely to include?
6. Suggest a number of topics which could well be reported in chart form, describing briefly how each chart would be prepared.

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[1] See *The Presentation of Costs for Executives;* publication of National Association of Cost Accountants, June, 1928.

XX

STANDARD COSTS AND THEIR USES

Meaning of Standard Costs

One of the most notable developments in cost accounting methods in recent years has been the introduction and the wider use of standard costs; in fact it may be said that nearly all cost systems which may in any way be called modern include some elements of standard costs at some part of the procedure. The precise definition of standard costs varies with different practitioners, but the one essential thing about them is that they serve as a basis of comparison, as a running commentary so to speak, upon the actual costs. An itemized list of expenses under the common account names of Supervision, Taxes, Insurance, Supplies Used, and so on, has little significance unless some standard is applied to it to indicate whether it is satisfactory or unsatisfactory; every business man will mentally apply such standards if they are not furnished in the report itself. Another aspect of standard costs is that they are prepared in advance, or *predetermined* as is often said; in this respect they are closely related to the business budget, though not necessarily identical with it. Standard costs, therefore, like the budget, offer the advantages of requiring that the operating plans of the business be carefully considered in advance, that the proposed costs be reviewed, and the financial results considered; when the program has been arranged, the standards set up in connection with it will afterwards serve as a mark to aim at; they will stimulate criticism of the actual results and will call attention especially to unsatisfactory features.

Standard Costs Are Reasonable

Standard costs are sometimes regarded with suspicion as tending to complicate the records and to obscure the real facts; but on the contrary it is the purpose of standard costs to simplify the records, and to bring out the important facts of the business all the more clearly. That there is nothing strange or unreasonable about them may be seen by considering two different classes of industry. In seasonal industries such as in the manufacture of ice cream or soft drinks, the actual costs per unit will vary enormously from month to month according as the volume of output goes up or down; these actual costs have no practical significance, and to get a cost per unit of product which has significance it is necessary to compute a figure which is based in some way upon the business of the entire year; such a figure may be regarded as a standard. Another case where a standard cost is natural and necessary occurs in all those industries in which it is the practice to determine a selling price for the product for the coming season, a price which presumably will remain unchanged throughout the season. In all such instances it is necessary to compute in advance a cost for the product. The materials, labor, and burden must be estimated from past experience, from the specification of the product as it will be in the future, and from the volume of production which it is expected to realize. If the cost so computed is used by the sales department as a basis for fixing prices, it is natural that this cost should be treated as a standard with which the actual costs of manufacturing will afterwards be compared.

Kinds of Standards

There is no general agreement as to a precise method of determining standard costs; as usual, the circumstances of the various companies call for different methods of arriving at the standards to be used. The literature on the subject of standard costs, which is very considerable, is therefore somewhat confusing, and it is necessary to ascertain, in any given case, exactly how the word standard is used. The statement is often made that it does not matter how the standard is set so long as one is used, which means that any standard is better than no standard at all. While this has some truth in it, any given set of figures which include comparisons between standards and actuals will be better understood if the nature of the standard is clearly in mind, and some standards will be better than others for a particular set of circumstances.

In many cases the standard cost is figured as an average of past costs or, if conditions are likely to be very different in the future, an average of estimated future costs. In a stable business, where expenses and volume of output continue with relatively little change, such an average would probably satisfy most authorities on standard costs. The difficulty is, however, that such conditions do not remain constant, and costs which have been a satisfactory standard in one set of circumstances will not continue satisfactory in another set of circumstances.

The term *normal* cost is often used in defining a standard cost; this means that, instead of averaging all costs, we select only those we regard as the more typical and perhaps average them. By this means we arrive at the *basic* standards referred to in the succeeding chapter.

Standards and Budgets

Another concept of standard costs is the budgeted or estimated cost for the forthcoming period; in fact, as already stated, standard costs are frequently connected with the budget. Here again the budget figures will frequently serve as good standards with which to compare the subsequent actual performance; it will always be of interest to the management to know how closely the actual figures come to the budgeted figures.

Ideal Standards

Even the budgeted costs are, however, not always so satisfactory as standard costs. In the minds of many people the term standard includes some element of what the cost ought to be, not perhaps under ideal conditions, but at any rate it ought to represent a very satisfactory performance, the reaching of which will be a credit to the manufacturing department, while failure to reach it would indicate by how far the factory is falling short of a high but perfectly attainable standard. In this sense neither the budgeted costs nor the average costs may be fully satisfactory; in either case they may be figured upon too low a volume of business, thus increasing the unit cost; or other unsatisfactory features may be included which might reasonably be improved upon. In such circumstances it would be desirable to revise the actual figures of the past, or the budgeted figures of the future, in the direction of setting the standard costs at lower figures, which would however be reasonably possible to attain if the unsatisfactory conditions were corrected.

In this sense, therefore, standard signifies a cost figure which would be reached if the plant were operated with a high degree of efficiency, but which is not impossible to attain.

Long-time or Short-time Standards

The main choice then is between standards which are chosen as being basic, which are to be used mainly as a means of measurement and which can therefore be used for a long time, or standards which are set as ideals and which in order to remain ideals must be changed quite often.

The next chapter is a full illustration of the use of basic standard costs. It is there shown how the standards and actuals are kept in terms of elements of costs, namely, materials, labor, and burden; how ratios are computed between these standards and actuals; and how, by the use of these ratios, the actual cost of any particular product or of an inventory can be computed.

Preparation of Standards

Clearly the procedure to be followed in setting standards will depend very largely on what kind of standards are to be set. If ideal standards are wanted, then selections will be made from among the high-grade performances of the past, in usage of materials and in labor or machine time taken, and the standards will be set accordingly. If, on the other hand, basic standards are to be set, then from among the past records choice will be made of those costs which seem to be most typical, and which therefore are likely to be most serviceable for a long time to come. First, standard specifications must be prepared for the products; then standard operations must be defined for the processing and routing of these products; then each process must be broken down into material, labor, and burden costs, and for each of these cost elements we must choose the most representative figures from the past records. Many variations will be noticed in the way the figures behave, when the past records are listed for this purpose; but usually it is not difficult to select from among them figures which are most likely to be typical of the future.

Changes in Standard Costs

Under ideal standards, changes will be somewhat frequent, and even with basic standards there will be occasional need of changes in the unit standard costs. For this purpose records must be kept of actual as compared with standard costs. Form 78 is a record for showing the actual and standard costs of different lots of a certain part. Changes in labor rates are also recorded, and from these it could be seen whether there was any need to change the standard cost of the part.

Standards as Related to Volume of Business

As is the case with a budget, the volume of business to be done has much to do with determining what standard costs are practicable; unit costs which would be perfectly reasonable with an output of 100,000 units per month would become quite impossible with an output of 50,000 units per month, because of the effect of the fixed charges in increasing the cost per unit when the output was diminished. If then the standards are set upon the former volume of output, it will probably be felt that they are no longer a fair basis of comparison when the output is actually reduced to 50,000 units per month. Many medium-sized and larger plants have accordingly worked out sets of standards to correspond with different volumes of output. These standards may be expressed in any of the terms noted above; in some cases a series of volumes of production will be assumed, and a standard will be set for each volume which represents the maximum costs which should be tolerated at that volume. In other cases the range of output may be estimated and only two sets of standard costs determined, one corresponding to the maximum range of output, and the other corresponding to the minimum range of output. The difficulty with such a provision is that the actual output is likely to fall between the two so that neither of them serves thoroughly well as a standard for comparison.

The amount of attention which the cost department can afford to give to this subject will naturally be in proportion to the size of the business and its volume of sales and also

MATERIAL			LABOR CHANGES			STANDARD UNIT COST PER 100					ACTUAL COST PER 100		VARIATION
DATE	AVER. COST	PER	DATE	TOTAL	PER	DATE	MATERIAL	LABOR	% BURDEN	COST	DATE	COST	PER 100

NAME	PART NUMBER	QUANTITY
SPECIFICATION		
REMARKS		

Form 78: Standard and actual costs of a part.

to the relative amounts of material, labor, and burden. In a fair-sized business in which the burden amounts to a considerable proportion of the total cost, say 50 per cent, it would probably pay well to examine the various expense accounts and observe what changes would occur in each of them at different levels of production; in this way a standard would be found for any likely volume of production.

Standard Costs for Materials

It is not necessary that the idea of standard costs should be applied alike to materials, labor, and burden; many companies use standards for one or two of these classes of costs without using them for all three. If materials are an important part of the total cost, however, it is likely to be worth while to set up standard costs for them. Variations from standard costs may arise in one of two ways: first, the actual purchase cost may be higher or lower than the standard cost; and, second, the quantity of material used per unit of product may be more or less than the standard allowance.

Materials Variations

With regard to the former variations, those arising from the purchase prices, there are two different methods of separating the standard and the actual costs. In some companies this is done on the invoice at the time the goods are purchased; the standard price is marked on the invoice, the materials are put into stock at that price, and the difference is picked up immediately and entered in an account called Variations on Purchases. Form 6 on page 66 is for use with this method. In other companies the materials are put into stores at the invoice price, but on the requisition by which they are taken from stores and issued to Work in Process the standard prices may be used so that the difference between standards and actuals is arrived at upon the goods which have been issued from stock into process. There is relatively little to choose between the two practices; a company will follow that one which will best accord with its organization.

Reasons for Standard Material Costs

One of the main reasons for the use of standard costs for materials is the fact that most of the cost accounting records are used to measure the efficiency of the factory; variations in the purchase price of materials have nothing to do with this efficiency, and it is, therefore, considered desirable to eliminate these variations before charging the materials into the factory. After that elimination has been made, then all variations in the cost figures will represent the responsibilities of the factory; if materials costs go up or down, it must mean that the factory is using more or less materials for a given quantity of output. This applies not only to direct materials to be incorporated in the product but also to supplies and expense materials.

If waste or scrap is a regularly recognized feature of production, it is then desirable to set up a standard allowance for waste or scrap, which allowance will be one of the regular charges to the department in which the waste or scrap occurs. Here again the standard should be set to represent a fair proficiency for the department so that it will serve in some respects as an incentive to accomplish. The records of the actual amounts of waste or scrap will then indicate by how much the department has bettered or failed to reach the standard set.

Standard Yields

Closely allied with standard material costs are the "yield" figures kept by so many industries and watched very closely by their managers. Yield means the percentage of the product which is obtained from a given quantity of raw materials processed. Where there is only one product, the figuring is often simple and so is the understanding of the figures. At a coal mine, for example, the yield is the percentage of real coal obtained from the material brought out of the mine, the balance being slate, stone, or other impurities. Some mine operators set much importance on this yield, which means that the car loaders below ground are told to be careful to put only good coal into the cars, thus saving the expense of loading, hoisting, and handling of waste. Other operators contend that it is easier and cheaper to sort the coal from the waste at the surface than underground and so do not compile or interpret their figures in the same way. The real test, of course, is the cost per ton of coal ready for delivery from the mines.

When several products are made, and especially if they are made jointly, such as in the manufacture of chemicals, in oil refining, in meat packing, or in many mining operations, the problem is more difficult. Nevertheless, it is desirable to figure the total percentage of all marketable products derived from the raw materials and also the percentage of each of the several products. Manufacturing effort will be made constantly in two directions, the first being to increase the aggregate percentage of yield of all products, and the second to increase the proportion of yield of the more valuable products.

These yields have significance in two main directions, both of which are important with regard to costs. The first has regard to the quality of raw materials processed and means that study should be made of which kinds of raw materials give the highest yields, relatively to their costs, in order that they may be bought. The second concerns the handling of those materials through the manufacturing processes, to see that there is the least possible amount of waste, and that the processes are controlled in all respects to give the best results.

Theoretical and Practical Yields

In most processing of this sort there comes a time when, although the greatest possible yield has not been secured from the materials in hand, yet it would cost more, in labor and burden, to recover the remaining good materials from the mass in hand than those materials would be worth, if recovered. At that point therefore profitable production ends, and it is more profitable to dump the remaining mass than to work it further.

Suppose, for example, that raw materials are bought containing a certain chemical; laboratory analysis shows that the raw materials contain 60 per cent of the desired pure materials and 40 per cent of waste. Suppose that, after certain processes have been repeated a number of times, 58 per cent of the product has been recovered; this means that 2 per cent remains in the 40 per cent waste. In other words, only about 5 per cent of the mass now left is good materials; it may not be worth while to put this entire mass through the processes again to recover that 5 per cent, and so the residue is dumped. Such action must depend upon experience and careful calculations of the labor and material costs of passing these materials through the various processes, as compared with the value of materials recovered. Sometimes these old and exhausted materials can be mixed with new and vigorous materials and something more of the pure chemicals may be recovered.

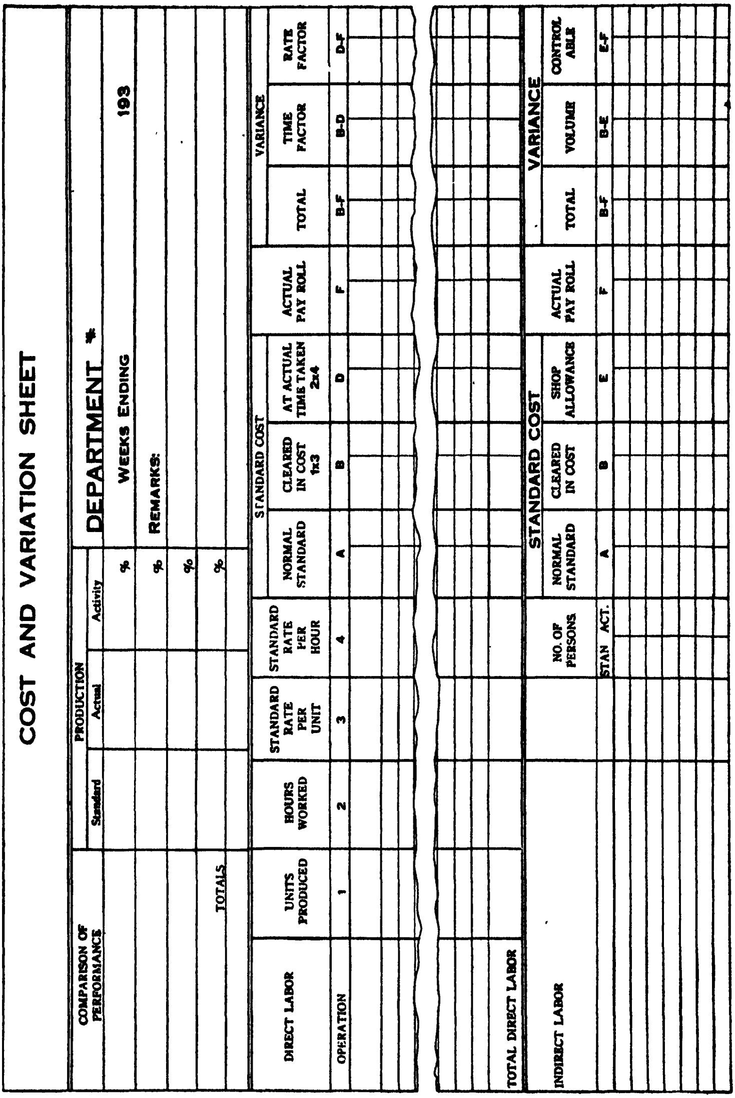
Standard Costs for Labor

Wherever labor costs are reported, it is helpful to set standards which will indicate, by comparison, when the actual performance of the labor force is above or below standard. The setting of standards for labor is usually done by the aid of time studies and of the labor records of past performance, the former being weighted the more heavily. Since one purpose of setting standards is to see how much improvement can be effected in the labor performance, it is not very logical to use the past performance as the standard of measurement; on the other hand, these records of past performance should be used as a check upon the time study results in order to avoid palpable errors. Time records will be kept on the ordinary job time tickets, except that spaces are provided for both the actual and the standard times in order that the difference may be shown; these time tickets are accumulated on posting sheets, by actual and standard, and the total differences per man or per department can be ascertained. In many cases a daily report on the performance of the department is prepared which will serve both as a constant measurement and a constant stimulus to the men in the department. The use of wage incentive plans, such as are discussed in Chapter IX, naturally involves using standard times for the various operations, as it is by doing better than standard time that the employee earns a premium or bonus.

One great inducement to the use of standard costs is found in those plants where numerous products are made, involving many and varied operations. In such cases the accumulation of actual costs on every operation and every lot of product becomes almost impossible. If instead of that standard labor costs are set, and upon these selling prices are fixed, then an adequate check upon actual labor costs is obtained if the totals are accumulated on an actual and on a standard basis, and the differences are observed.

Labor Cost and Variation Sheet

Form 79 is an example of the type of sheet used to analyze labor variations from standard. The upper left part of the sheet shows the actual rate of production compared with standard; this may be expressed in man hours or machine hours, as may be convenient. If a department consists of



COST AND VARIATION SHEET

COMPARISON OF PERFORMANCE	PRODUCTION Standard	PRODUCTION Actual	PRODUCTION Activity	DEPARTMENT *
			%	WEEKS ENDING 193
			%	REMARKS:
			%	
TOTALS			%	

DIRECT LABOR	UNITS PRODUCED	HOURS WORKED	STANDARD RATE PER UNIT	STANDARD RATE PER HOUR	STANDARD COST NORMAL STANDARD	STANDARD COST CLEARED IN COST 1x3	STANDARD COST AT ACTUAL TIME TAKEN 2x4	ACTUAL PAY ROLL	VARIANCE TOTAL	VARIANCE TIME FACTOR	VARIANCE RATE FACTOR
OPERATION	1	2	3	4	A	B	D	F	B-F	B-D	D-F
TOTAL DIRECT LABOR											

INDIRECT LABOR		NO. OF PERSONS	STANDARD COST NORMAL STANDARD	STANDARD COST CLEARED IN COST	STANDARD COST SHOP ALLOWANCE	ACTUAL PAY ROLL	VARIANCE TOTAL	VARIANCE VOLUME	VARIANCE CONTROLLABLE
		STAN ACT.	A	B	E	F	B-F	B-E	E-F

Form 79: Cost and variation sheet.

60 similar machines, of which in normal times 50 are busy for 8 hr. a day, 5½ days in the week, then a standard week would be 50 × 8 × 5½ = 2,200 machine hours. If a certain week

then showed 1,900 hr. actually operated by machines, the per cent of activity would be 1,900/2,200 = 86.4 per cent.

The middle part deals with direct labor in the department, the workers being divided into groups by operations. Columns 1 to 4 give the basic facts. Column *A* then shows the normal standard cost, that is to say, the standard costs based on normal conditions as to volume of output, conditions of manufacture, and so forth. In many cases this column is not used at all, though advantage may be found in giving consideration to this phase occasionally. Column *B* contains the standard cost of the actual units produced, while *D* is the standard cost of the actual time taken. Next comes *F*, the actual payroll column, the comparison of which with the standards, supplies the variances. The total amount of variance to be explained is found by subtracting column *F*, the actual cost of the actual output, from column *B*, the standard cost of the actual output. This total variance may be due to more or less than standard time having been taken to turn out the product or to higher or lower than standard wages having been paid or, as in Form 79, to a combination of these two factors. Since *B* shows the cost at the standard per unit and *D* the cost at the standard per hour, the difference between these two is the time factor, while *D* minus *F* is the variation due to rate changes.

A similar analysis of indirect labor is given in the lower half, though here the variances are classified either as due to changes in the volume of production or as being due to changes in expense rates, which are called therefore controllable variances. A monthly study of such labor variations can bring to light much valuable information of a cost-saving nature.

Quantity Standards for Labor

In some of our most highly organized and best managed plants, labor standards are expressed in production per day or per hour or sometimes in the average number of minutes required to produce each piece. Perhaps wages are paid at a day or hourly rate, with or without a bonus; it is then figured that a certain rate of production per hour is satisfactory, while below that is unsatisfactory. If a daily report is prepared on the production of such a department, it may contain information in the following form:

Man hours worked	673
Actual production, pieces	1,954
Standard production, pieces	1,937
Excess production, pieces	17
Shortage in production, pieces	

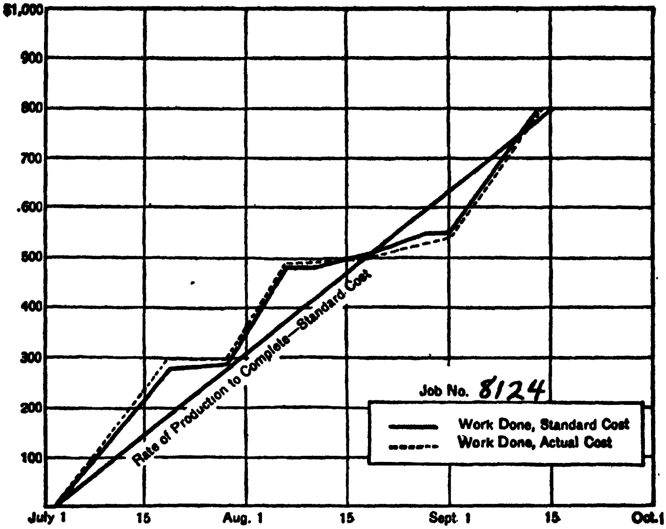
The foregoing form may be very suitable where uniform and standardized parts are being made; if several different parts are being processed at the same time, the report might be put up in the following terms:

Actual man, minutes worked	51,240
Production in standard man, minutes	50,874
Time taken under standard	
Time taken above standard	366

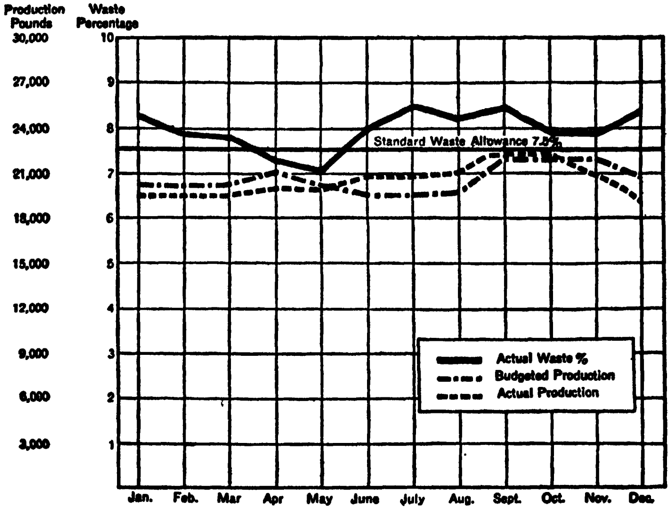
The foregoing examples are typical of the simple types of labor standards which are found in mass production industries, where production is highly organized largely on automatic machines, and where the labor may be a relatively small part of the cost, so that if labor is inefficient it means that much more than the labor cost is lost in overhead. The cost per part is figured in advance on a standard rate of production basis; it is then known what the cost will be if that standard rate of production is maintained. But if production comes at a lower rate, the costs will be higher, and *vice versa;* efforts to control the costs therefore take the form of maintaining or bettering the standard rate of production. In such cases continuous costs in money are not kept; but because of the very careful calculations which are made in advance of standard costs for standard production, and because of the strict check kept on the rate of production, such a company has at all times a very good knowledge of its costs.

Standard Costs for Burden

In the chapters dealing with burden accumulation and distribution it has been seen that it is ordinarily impossible to make direct charges of specific burden costs to specific orders or lots of product; the nature of burden is that it consists of the general expenses which apply to production as a whole and not to specific units. The cost department is, therefore, under the necessity of finding some method of prorating the burden to various orders or lots of product. What is more, it is necessary to work out burden rates in advance, which can be charged to individual orders as they go through the plant, if the cost of such orders is to be ascertained. This means that standard rates for burden are practically a necessity; the items of expense entering into burden must be estimated



Form 80: Chart of job progress and costs.



Form 81: Chart of production and waste.

as carefully as possible, and so also must the total volume of production. If these are estimated from the point of view already mentioned, namely, that they should reflect a satisfactory level of accomplishment, then the burden rates resulting from them will serve very well as standards, and variations from them will have the same significance as in the case of materials and labor.

Form 80, in graphic form, shows the actual progress of the costs of a job, at standard and actual, compared with a standard rate of production.

Form 81 shows in graphic form the record of production and waste for a department, as compared with standard. These are but two examples of a great variety of uses of standard costs for giving more meaning to the actual costs.

Valuation of Inventories at Standard Cost

When standard costs are being used as bases for charging production orders, the resulting values to be attached to Work in Process and to Finished Goods will naturally be standard values, and the question will arise as to whether these are satisfactory for balance sheet purposes. In considering this question it is only necessary to recall the ordinary rules for valuing inventories of Work in Process and Finished Goods for balance sheet purposes, namely, at cost or market, whichever is the lower. This usually means cost for the Work in Process because very often there is no market quotation available for materials in that partly worked condition. The only question is, therefore, whether the standard cost is more satisfactory than the so-called actual cost for balance sheet purposes. What will actually happen is that the auditors will test an inventory valued at standard to see how it compares with the cost or market basis; in many cases the result will be that the standard values show very little difference from the values on a cost or market basis, in which case the auditors will accept it without further question. If, however, there are considerable differences, it becomes necessary to inquire into the cause and nature of those differences. In the case of a seasonal business already referred to, no auditor would be willing to accept the actual cost which would be obtained by loading all the overhead on a very small volume of output in the dull season. Such a valuation would be grossly exaggerated and would itself be far in excess of current market values; a standard valuation would be far more reasonable to use and far more readily accepted than any such valuation on an actual basis. If, on the other hand, it transpired that the inventory valued at standard costs was largely in excess of present market values, because the latter had recently declined, then it would be necessary to adjust the inventory to a market valuation, in just the same way as if the inventory had been valued at actual costs. In other words, no new problem of inventory valuation arises when standard costs are used; the same rules for testing, checking, and valuing the inventory will apply, and the same procedure will be followed.

Ascertaining the Cost of Goods Sold

In obtaining a proper inventory value, there also arises the question of obtaining a proper figure for the Cost of Goods Sold in the operating statement. The latter question includes, however, the matter of the treatment of the variations between standard and actual costs which have occurred during the period; if these are not closed into the Cost of Goods Sold, they will be left to be closed into the Profit and Loss account. The usual view of auditors on this subject is that they should be closed into Cost of Goods Sold in order that a proper figure of gross profit or gross margin may be shown on an actual basis. In final statements prepared at the end of the fiscal period, especially if they are for publication, it is likely that this treatment will be followed; in statements prepared for purely internal purposes at the end of each month it may be considered satisfactory to allow the balances in the variation accounts to remain open in the cost ledger, where they will be treated as part of the inventory of work in process. This will not, however, prevent a proper showing of costs and profits in the reports prepared for the officers, in which the actual net profit will be shown, even though the variations may be given as separate amounts. When, therefore, these variations are closed into Cost of Goods Sold at the end of the year, there will be no sudden change in profits due to the actual profits now being shown in the books.

Operating Statement with Variations from Standard

For example, the operating statement of a company using standard costs might appear in part as follows:

Operating Statement, Month of September, 1932 and Year to Date

	Month ending Sept. 30, 1931	Eight months ending Sept. 30, 1931
Net Sales	$56,842	$497,335
Less: Cost of Goods Sold		
Materials Used, Actual	20,887	185,474
Labor, Direct, Standard	9,583	89,145
Burden, Standard	10,739	89,321
Total Costs	41,209	363,940
Gross Profit, at Standard Costs:	$15,633	$133,395
Less: Variances:		
Labor Excess	524	5,210
Burden Excess	1,390	9,680
Gross Profit, Actual	$13,719	$118,505

If an operating statement were prepared on the ordinary basis, with no reference whatever to standard costs, the gross profits for the respective periods would be the same as on the last line in the foregoing form. But if the foregoing statement used only the line Gross Profit, at Standard Costs, and omitted the variances, the final net profits could not, of course, be reliable or complete. After the Gross Profit, Actual, the last line above, would follow the selling and administrative costs and other charges, ending in the final net profit in the ordinary way.

Standard Costs in Departmental Operating Statements

Another application of standard costs occurs in the preparation of departmental operating statements, especially when the departments are separate selling outlets for goods manufactured in the same departments. In such cases it is not possible to get the separate actual manufacturing costs of the goods sold through the different outlets, unless it is the practice to cost each lot on a job cost basis, and even the standard burden rates must be used. If it is not feasible or desirable to use job costs for every lot, then an operating statement on a departmental basis can be obtained, in the conditions described, only by using standard costs of production for the goods sold through the different outlets. In this case, and also in the case of using job costs with a standard burden rate, the total manufacturing costs so compiled will differ from the total manufacturing costs made up from the financial records, by reason of the variances which always arise between standard and actual costs.

Thus suppose that the operating statement on page 373 related to a company which sold its products through two different outlets, known as Department K and Department S, and that the eight months' sales of $497,355 were made up of $264,838 for Department K and the balance for Department S. Suppose further that these goods were all made in the same plant by substantially the same processes and were in fact similar goods, though not identical. Standard costs have been found for these goods as follows:

Department K: 51,970 units @ $4.00	$207,880
Department S: 34,680 units @ 4.50	156,060
Total	$363,940

The departmental operating statement would then appear thus:

OPERATING STATEMENT, EIGHT MONTHS ENDING SEPTEMBER 30, 1931

	Department K	Department S	Total
Net Sales	$264,838	$232,497	$497,335
Manufacturing Cost, Standard	207,880	156,060	363,940
Gross Profit, at Standard Costs	$ 56,958	$ 76,437	$133,395
Less: Variances			
Labor Excess			5,210
Burden Excess			9,680
Gross Profit, Actual			$118,505

This departmental statement may be prepared in greater detail for the standard costs and variations if the management wishes. The total standard cost may be subdivided into materials, labor, and burden standards, as shown in the form on page 377; and the variations could be apportioned between the two departments in proportion to the labor and burden costs of each. The latter, however, would be a somewhat arbitrary procedure.

But this departmental statement could not, under the conditions described, be set up with separate actual manufacturing costs. If all products are made in the same departments, they incur most of their costs jointly; the separate selling outlets have nothing to do with manufacturing efficiency; which may be measured by applying standards to the operating expenses of the whole plant. If because of the two distinct selling departments it is desired to show a departmental statement, the standard costs are adequate and very useful for that purpose.

Illustration of Closing Variation Accounts

The different ways in which variations between actual and standard costs may be treated, as discussed in the foregoing paragraphs, will best be shown by an actual example. For this purpose the following trial balance of a ledger may be used; it is here assumed that all the factory accounts are kept in the general ledger:

TRIAL BALANCE, NOVEMBER 30, 19—

1. Cash	$ 10,000	
2. Accounts Receivable	15,000	
3. Inventory, Finished Goods	18,000	
4. Inventory, Work in Process	12,000	
5. Inventory, Raw Materials	14,000	
6. Plant and Machinery	35,000	
7. Accounts Payable		$ 11,000
8. Capital Stock		65,000
9. Surplus		16,000
10. Sales		110,000
11. Cost of Goods Sold	80,000	
12. Direct Labor	31,000	
13. Direct Labor Distributed		29,500
14. Manufacturing Expenses	26,000	
15. Manufacturing Expenses Distributed		24,000
16. Variations on Materials Used		1,500
17. Selling Expenses	10,000	
18. Administrative Expenses	6,000	
	$257,000	$257,000

In the foregoing trial balance, Account 12, Direct Labor, shows the actual amount of direct wages paid; the following account, No. 13, shows the amount of labor charged into Work in Process, by charging all the various units of work for direct labor at standard rates; the difference of $1,500 is therefore the excess of actual over standard. The same relationship exists between Accounts 14 and 15; the actual burden expenses incurred have been $2,000 more than the burden which has been charged, at standard rates, against the product, as the various lots or jobs have gone through. With materials, on the other hand, there has been a gain: when they were transferred from Raw Material Stores and charged to Goods in Process at standard prices, those standards were found to be more than the actual costs of the materials by $1,500, which is therefore found as a credit balance in Account 16.

Closing Variations Account

If it is now desired to prepare an operating statement and balance sheet, the variations in cost might be closed into Cost of Goods Sold by the following journal entry:

Cost of Goods Sold	$2,000	
Variations on Materials Used	1,500	
To Direct Labor Distributed		$1,500
Manufacturing Expenses Distributed		2,000

The posting of this entry would bring all the accounts representing standard costs to equality with the actual costs, closing the differences into Cost of Goods Sold. The operating statement would then read as follows:

Sales for Period		$110,000
Less: Cost of Goods Sold		82,000
Gross Profit on Sales		$ 28,000
Less: Selling Expenses	$10,000	
Administrative Expenses	6,000	16,000
Net Profit from Operations		$ 12,000

If, on the other hand, the adjustments shown in the foregoing journal entry were made into Profit and Loss, instead of into Cost of Goods Sold, the operating statement would be as follows:

Sales for Period		$110,000
Less: Cost of Goods Sold (Standard)		80,000
Gross Profit on Sales		$ 30,000
Less: Selling Expenses	$10,000	
Administrative Expenses	6,000	
Adjustments of Standards to Actuals	2,000	18,000
Net Profit from Operations		$ 12,000

Of these two operating statements the former is preferable, as it shows all manufacturing costs in Cost of Goods Sold and, as a result, a correct gross profit. The latter statement, on the other hand, brings into combination with the selling and administrative expenses an item which is really part of the manufacturing cost. The proper way, therefore, is to arrange the operating statement as in the former example, and to supplement it by an additional statement to the officers and directors as follows:

Analysis of Cost of Goods Sold

	Actual	Standard	Loss or gain
Materials Used..................	$22,500	$24,000	$*1,500*
Direct Labor....................	32,000	30,500	1,500
Manufacturing Expenses.........	27,500	25,500	2,000
Total......................	$82,000	$80,000	$2,000

It will be noted that the foregoing figures are slightly different from those in the trial balance; this is because they are the material, labor, and burden costs in the goods *sold* during the period, whereas the figures in the trial balance represent the elements of cost in the goods *made* during the period; the corresponding adjustments will be in the inventories of work in process and finished goods.

Closing Variations into Profit and Loss

Some accountants think that, instead of closing variances into Cost of Goods Sold and thus showing there the actual gross profit, they should be closed into Profit and Loss, as shown in the second form on page 376. In some cases the variations are divided into those arising from controllable expenses and those of noncontrollable expenses, the former being regarded as an addition to the Cost of Goods Sold and the latter as a charge to Profit and Loss. The reason for this distinction is that variations on controllable expenses consist mostly of increases and decreases in the amounts of expense items; in other words, they are parts of the actual current costs of operations. Variations in the noncontrollable expenses, on the other hand, are more likely to be due to changes in volume of business done and the inability of the fixed charges to adapt themselves to these changes. It is therefore natural to regard the former group of variations as elements in the Cost of Goods Sold or in inventory if they are not sold. The latter group, on the other hand, are due to external conditions and have nothing directly to do with the manufacturing operations going on in the shops. It is not likely, however, that many companies will go to this much trouble in the matter. As already stated, the main object of discovering these variations is to trace them to their causes and to deal with those causes; for this purpose an analysis of variations similar to that shown on Form 79 is the most helpful thing. In a profit and loss statement the officers and directors will usually be content either with a form similar to that on page 373, or they will simply want to see the actual cost of goods sold with no separate mention there of the variations.

The handling of these variations in the ledger will be determined by what is decided about the presentation of them in the operating statement. In so far as they are there made an addition to or subtraction from the Cost of Goods Sold, they will be closed into that account in the ledger. If they are made a subsequent addition to or deduction from the net profit part of the operating statement, they will be closed into Profit and Loss account in the ledger. But the statements and reports are the places in which executives see them and make use of them in management.

Inclusion of Standard Costs in Books of Account

In the foregoing example it is assumed that transfers for materials, labor, and burden into the Work in Process account, and from there to Finished Goods and to Cost of Goods Sold, have been made at standard prices; it is in this way that the differences have arisen. Many people believe, however, that in the ledgers themselves only actual prices should be recorded, and that the standards should be kept as statistical records outside the books. Their reason for this point of view is that they believe the books of account will be clearer and more simple if they record actual cost only, and just the same results are arrived at by keeping these standard costs outside the books. In the case given above, for example, the operating statement first given would result directly from the books kept with actual costs only, and the statement entitled "analysis of cost of goods sold" could be prepared, the actual figures from the books, and the standard figures from the outside compilations. There would thus be no difference in the amount of information available; it is only a question of method. The reason why many prefer to include these standard costs in the books of account is that they are more likely to be carefully and accurately worked out, since they have to be balanced with the double-entry system. It is, moreover, frequently just as easy to include the standard costs in the books in this way as to keep the books on an actual basis throughout. If, however, any actual difficulty arises in incorporating the standard costs in the books, then it is quite reasonable to assemble them separately.

Reserve for Burden Adjustment

As a result of charging Work in Process with standard burden rates, it has been seen that every month there will be a discrepancy to be adjusted between the actual amount of burden incurred, and the amount applied against production. This adjustment is likely to be first on one side of the books and then on the other; in periods of high production there will be a credit balance in the Burden account and in periods of low production a debit balance. To meet this situation, some accountants like to set up an account entitled Reserve for Burden Adjustment. To this account they will credit a small amount every month, the corresponding debit being into the Work in Process, where it is included with the actual burden expenses. The main object accomplished by this device is that it provides a margin of safety in the burden distribution; all the burden expenses which can actually be foreseen having been listed, this small extra amount is added as a precaution to be sure that the burden rates will be high enough to cover contingencies. In this way a credit balance is gradually accumulated in the reserve for the Burden Adjustment amount; and when the difference is found between actual and standard burden, it can be transferred into this account. If then the actual burden has exceeded the standard burden, the debit balance resulting will be charged against this reserve, and the amount which will then have to be charged extra against the Cost of Goods Sold will be less than if the entire discrepancy were thus transferred direct to Cost of Goods Sold. In fact the tendency will be for the Reserve for Burden Adjustment to keep a credit balance even after the burden differences have been transferred into it, which will mean that, instead of having to add to the standard Cost of Goods Sold and thus reduce the Profit, it is more likely to be the other way around; the credit balance in Reserve for Burden Adjustment will go to reduce slightly the Cost of Goods Sold and to increase the Profit.

How Often Should Standards Be Changed?

Since the standard costs are designed primarily to serve as a basis for judging and comparing the actual costs, it is advantageous if they can be kept unchanged for a considerable period of time; in this way executives become accustomed to the standards and learn to note quickly the differences between standard and actual costs and to understand their significance. Under these circumstances the best results of standard costs are obtained. On the other hand, it must be borne in mind that the standards are supposed to represent a mark to aim at, a high level of performance. If conditions change materially, this will not be true unless the standard costs are changed to correspond. If the method of performing certain machine operations is considerably changed, thus shortening the time and reducing the cost of the operations, the standard costs set up before the change will no longer represent a satisfactory performance; similarly if material prices are reduced in the market, the standards based on the old prices will no longer be significant. If these changes are considered to be merely temporary fluctuations, they should not be regarded as a reason for changing the standards; in fact it is the very object of the standards to measure and to call attention to such temporary fluctuations. If, on the other hand, the changes are likely to be of a permanent nature, such as the case in which cheaper ways of performing the operation have been devised, then it becomes desirable to make a change in the standards. Such changes in method would usually be accompanied by a change in the piece rates; and if the piece rates were the standard labor rates, the change of standard would be immediate. In practice the standards will have to be revised according to the conditions prevailing in the particular business; some companies go over their standards regularly twice a year, changing those which need to be revised. In other cases still more frequent changes may be necessary, but with many companies the standards may remain unchanged for a full year.

QUESTIONS AND PROBLEMS

FOWLER FLOUR MILLS

1. The Fowler Flour Mills operate with steam power generated in their own power plant, with water power from the near-by river, and with electric power purchased from the city. Water power is much cheaper, but under the lease conditions the amount of water power available varies greatly from time to time. Steam power is next cheaper, and electric power the dearest. Economy consists largely in switching promptly to the cheaper power whenever it is available. Experience shows that, under the most favorable conditions, 3,500,000 bbl. of flour may be ground with the following combination of power:

	Horse power-hours	Cost
Water	12,500,000	$ 62,300
Steam	5,000,000	49,600
Electric	5,000,000	98,100
Total	22,500,000	$210,000

The company desires that the accounts shall show:

a. The total cost of each kind of power.

b. The cost per horse power-hour for each kind of power.

c. The power cost per barrel of flour ground, regardless of the kind of power used.

d. The efficiency of production of each kind of power.

e. The efficiency in using the cheapest power available.

Schedules A and B below show the cost for three months ending December 31, 1924; Schedule C shows the principal statistics for the preceding five years.

Enter the costs from Schedules A and B into the power ledger accounts, so as to show the desired information, explaining precisely how the information is obtained from your accounts.

A. SCHEDULE OF FIXED CHARGES

Account	Steam generating plant	Steam distributing plant	Water power equipment	Electric power equipment	Total fixed charges
Depreciation	$3,000	$ 750	$ 600	$1,600	$ 5,950
Taxes	900	250	180	500	1,830
Insurance	600	150	120	350	1,220
Interest	1,800	450	360	1,000	3,610
Total	$6,300	$1,600	$1,260	$3,450	$12,610

B. SCHEDULE OF VARIABLE CHARGES

Account	Steam generation	Steam distribution	Water power	Electric power	Totals
Labor	$ 2,150	$ 350	$ 300	$ 250	$ 3,050
Supervision	1,800	300	200	150	2,450
Fuel	4,200				4,200
Repairs and Maintenance:					
Labor	1,200	400	600	650	2,850
Materials	850	200	400	450	1,900
Supplies	450	100	200	150	900
Total	$10,650	$1,350	$1,700	$1,650	15,350
Other Charges					
Payments on Water Leases	$13,000				
Payments for Electric Current	$23,900				

Steam generated has in the past cost 0.0625¢ per pound. During these three months 27,000,000 lb. were generated, of which 12,000,000 were used for heating, the remainder being delivered to the steam power distribution system.

Power delivered by steam plant, horse power-hours	1,210,000
Power delivered by water plant, horse power-hours	3,200,000
Power delivered by electric plant, horse power-hours	1,425,000
Barrels of flour ground during the 3 months	930,000

C. STATISTICS OF LAST FIVE YEARS

Year ending Sept. 30	Barrels ground, 000 omitted	Total costs	Steam power		Electric power		Water power	
			Hp.-hr., 000 omitted	Costs—net, 000 omitted	Hp.-hr., 000 omitted	Costs, 000 omitted	Hp.-hr., 000 omitted	Costs
1920	3,200	$ 210,000	4,330	$ 43	5,300	$110	11,450	$ 57,000
1921	3,300	215,000	4,420	44	5,750	113	11,750	58,000
1922	3,450	224,000	4,580	46	6,000	118	12,100	60,000
1923	3,600	230,000	4,890	49	5,800	120	15,150	61,000
1924	3,350	219,500	4,490	45	6,010	116	11,470	58,500
Totals	16,900	$1,098,500	22,710	$227	28,860	$577	61,920	$294,500

2. A company used Form 79 to report and analyze its labor variances monthly. For a certain department columns 1 to 4 and column *F* were filled in as follows:

Operation	1	2	3	4	*F*
4	184560	16300	4¢	45¢	$ 7,395.60
5	235380	14970	3¢	48¢	7,004.50
6	188750	19450	5¢	50¢	9,449.40
7	350680	22770	3¢	45¢	10,674.70
8	135870	13340	4¢	40¢	5,598.20

Using five columns, two for *B* and *D*, and three for Variances, as in Form 79, fill in the proper figures from the foregoing on five lines corresponding to the operation numbers.

3. The officers and directors of the Chepstow Manufacturing Company received every month a profit and loss statement of their operations, in form and contents as shown below:

CHEPSTOW MANUFACTURING COMPANY
PROFIT AND LOSS STATEMENT FOR MONTH ENDING OCTOBER 31, 1932

Sales for Month				$438,250.00
Less: Returns and Allowances			$ 11,360.00	
Discounts on Sales			1,949.00	13,309.00
				$424,941.00
Less: Cost of Goods Sold				
Inventory, Finished Goods, Oct. 1			$182,925.00	
Work in Process, Oct. 1		$ 77,260.00		
Raw Materials, Oct. 1	$209,770.00			
Purchases of Raw Materials	94,375.00			
	$304,145.00			
Less: Inventory, Raw Materials, Oct. 31	88,780.00			
Raw Materials Used		215,365.00		
Labor Direct		49,340.00		
Labor Indirect		27,895.00		
Supplies Used		14,160.00		
Supervision		8,485.00		
Depreciation		30,935.00		
Taxes		17,260.00		
Insurance		1,480.00		
Repairs and Maintenance		12,675.00		
Total Manufacturing Expenses		$454,855.00		
Less: Inventory in Process, Oct. 31		84,935.00		
Cost of Goods Finished			369,920.00	
Total Finished Goods Handled			$552,845.00	
Less: Inventory of Finished Goods, Oct. 31			194,480.00	
Cost of Goods Sold				358,365.00
Gross Profit for Period				$ 66,576.00
Less: Selling Expenses			$ 39,815.00	
Administrative Expenses			44,390.00	
Total Selling and Administrative				84,205.00
Net Loss for Period				$ 17,629.00

The company had two main outlets for its sales, each dealing with a different class of customers; for purposes of this case these two classes of business may be spoken of as Department A and Department B. The products sold through these two channels were in many cases alike, so that goods were not identified, while going through the manufacturing departments, as being Department A or Department B goods. A common stock of finished goods was also held at the service of both departments, so that it was only after the goods had been actually sold that they could be classified along departmental lines. Separate sales accounts were kept and from these it was known that in October, 1932, the sales total was made up as follows:

Sales: Department A Products	$295,810	
Sales: Department B Products	142,440	
		$438,250

At one of the monthly meetings question was raised by some directors as to the possibilities of drawing up the entire income statement along departmental lines with a view to showing the net results of each department. They were anxious to see these separate results, the more so as Department B was somewhat of a new venture. Upon inquiry from the accounting department it was found that very few figures were available on a separate departmental basis; in fact the following were about all the items of this nature which could be found in the ledger:

	Department A	Department B
Returns and Allowances	$ 7,680	$ 3,680
Discounts on Sales	1,310	639
Selling Expenses	24,190	15,625

Beyond the information already given, the only available facts which seemed to have a bearing on the subject were the following unit costs:

Unit Costs and Quantities Sold

Department	Division	Cost per unit	Number sold
A	1	$1.50	56,000
A	2	2.00	41,600
A	3	1.25	48,000
B	1	1.35	20,000
B	2	1.75	40,000

The foregoing unit costs were computed every half year as a basis for the determination of selling prices for the coming period. They contained the actual costs of direct labor and materials current at the beginning of the season as closely as these could be ascertained; for burden a normal charge based upon a normal volume of operation was included. The accounting department felt that it might be able to make up something along departmental lines from these figures. With regard to administrative expenses, this item related to both departments, and it was felt that only an arbitrary allocation could be made.

Prepare a departmental operating statement as complete as the materials given will permit. In doing so, make what assumptions seem reasonable in regard to administrative expenses, but state your assumptions.

Comment upon the statement you have prepared for the preceding question, pointing out what you regard as its limitations.

In the light of your experience with the preceding question, state what you think would be necessary before a reliable departmental statement could be prepared.

Explain the difference, if any, in gross and net profits for the whole company as shown by your statement as compared with those in the full profit and loss statement prepared from the ledger.

In your judgment what is the best way of meeting the wishes of these directors for departmental monthly statements?

4. What are the differences between standard costs, actual costs, estimated costs, and budgeted costs?

5. Outline the steps you would take in installing a system of standard costs.

XXI

DANA CARPET COMPANY—BASIC STANDARD COSTS[1]

The Dana Carpet Company operated a number of mills producing a variety of rugs and carpets. This case relates to the operations of only one of these mills, in which Axminster carpets and rugs were manufactured.

Standard Cost File of Products

The company utilized a system of basic standard costs. A permanent file of basic standard cost sheets was maintained, each sheet being a summary of the standard labor and expense for all the operations performed on a given grade and size of carpet, together with the standard cost of the material used in it.

Standard Cost of Material

Standard prices were established for all direct materials, based on the level of prices under ordinary market conditions. These prices were placed on file and were not changed except perhaps after a considerable period of time when they had become no longer representative of normal conditions. Standard quantities of materials used for a given carpet were figured at these standard prices in arriving at the standard cost of material for that carpet.

Standard Cost of Labor

The standard per product cost of labor had been developed by setting standard costs for each operation in each department for each size and grade of product, based on existing piece work or hourly rates. Standard labor costs per product were changed only when the method of manufacture changed.

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[1] See E. A. Camman, *Basic Standard Costs*, American Institute Publishing Company, New York, 1932.

Standard Overhead Costs

Prior to the opening of each year a manufacturing expense (overhead) budget was prepared, in which the expected overhead for the coming year was divided into production or burden centers.[1] Standard machine-hour rates were then developed by dividing the amount budgeted to the machine groups by the normal number of hours at which each group was expected to operate. Where machine-hour rates could not be used, burden rates were stated as percentages of labor. The hourly rates in turn were converted to standard costs per unit of product by dividing them by the standard quantities produced per machine hour in the various operations or by applying the established percentage to the standard labor cost of the unit of product.

Standard overhead costs and rates were not changed within the year unless a change was made in the equipment or in the arrangement of the producing department.

Cost Ledger

The operations of the various mills were controlled by accounts in the general ledger. A cost ledger was maintained for each mill, and included inventories of raw materials, work in process, and finished goods. An account entitled General Ledger Control was maintained in each cost ledger, putting it on a double-entry basis. This account was credited when purchases and labor were charged to the cost ledger and debited for transfers from the cost ledger to the general ledger, that is, for cost of goods sold. Some of the accounts had special columnar rulings, as shown later.

Cost Accounting Procedure

Inventory accounts, supported by perpetual inventory cards, were kept in the cost ledger for each class of material. Work in process was split into several material in process accounts and an account for total labor and expense in process. Material was charged to the process accounts at both actual cost and standard cost after pricing and summarizing the material requisitions for the period. The actual burden expenses were first gathered in two groups of accounts marked Controllable and Noncontrollable; from here they and the labor charges were transferred, by methods shown later, to a series of departmental labor and expense in process accounts. In these there were throughout additional columns for standard labor and expense amounts. All of these actual and standard costs were then transferred into a total labor and expense in process account. The following diagram shows this general plan:

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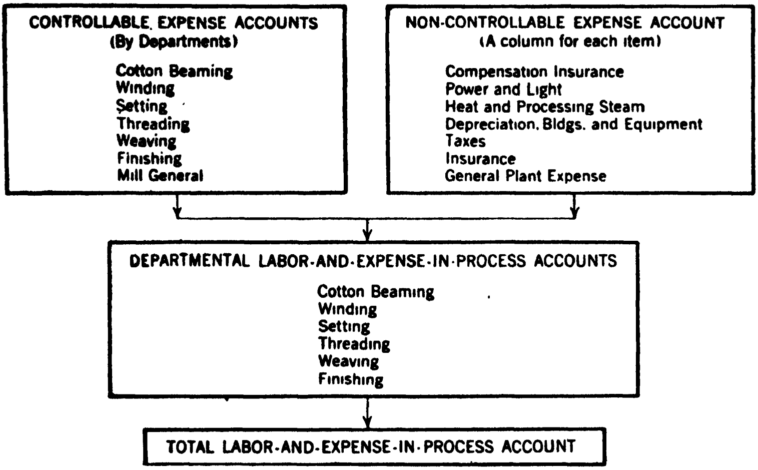
[1] Spindle-hour groups were also used in the production of yarn in mills with spinning departments, but the Axminster mill started with yarn as a raw material.



For controllable expenses there were seven accounts, one for each of six departments, and one for mill general; for noncontrollable expenses there was only one account, but seven columns were provided for seven different classes of expense.

After all of the costs were gathered in the process accounts, ratios were computed for each account showing the percentage relationship between actual cost and standard cost. The total production of finished goods for the month was summarized by types and sizes of rug and priced from the standard cost file of products to determine the standard costs of materials, labor, and burden in them. The ratios developed in the process accounts were then applied to these standard costs in order to arrive at the actual cost of goods finished. An entry was then made debiting the finished goods accounts and crediting the process accounts, for both the actual cost and standard cost of goods finished.

To make this clear, a practical example will now be worked out by the student. The work to be performed relates to the cost ledger of the Axminster mill. The transactions for the month of August have been summarized to show clearly the elements of cost and to shorten the work in this case. The account balances as of August 1, 19— are given in the trial balance below; set them up in ledger accounts ruled with two debit and two credit columns, one for standard and one for actual on each side, except for the Labor and Expense account, which is illustrated later.

TRIAL BALANCE, AUGUST 1, 19—

	Debit		Credit	
	Actual	Standard	Actual	Standard
1. Axminster Colored Yarn Stock	$ 84,229.03	$ 142,022.27		
2. Cotton Yarn Stock	47,656.80			
3. Jute Yarn Stock	28,222.32			
4. Fringe Stock	728.99	965.30		
5. Binding Materials Stock	631.64			
6. Packing and Baling Materials Stock	18,020.79			
7. Miscellaneous Waste Stock	17,238.89			
8. General Factory Supplies	44,930.28			
9. Repair Materials Stock				
10. Undistributed Freight	5,404.53			
11. Minor Supplies Stores	24,652.84			
12. Surface Yarn in Process	53,980.34	80,246.22		
13. Cotton Yarn in Process	33,998.85	61,296.49		
14. Jute in Process	9,263.98	14,384.20		
15. Finishing Materials in Process	2,853.55	3,672.09		
16. Labor and Burden in Process	17,789.56	19,073.99		
17. Finished Goods	1,289,666.98	1,769,826.86		
18. General Ledger Control			$1,679,269.37	
19. Standard Cost Control				$2,091,487.42
Totals	$1,679,269.37	$2,091,487.42	$1,679,269.37	$2,091,487.42

Material Inventory Accounts

The detailed inventory records of stores were kept by a material control department, which had a set of inventory cards and attended to the ordering, receiving, storing, and issuing of materials. These cards were checked periodically to agree with the control accounts for stores in the cost ledger. These accounts with their balances as of August 1, 19— are numbered 1 to 11, inclusive, in the trial balance.

Both actual and standard costs were shown for Axminster colored yarn stock and fringe stock, for these items were produced in other mills owned by the company, from which they were transferred out at standard and actual. Other items were inventoried only at actual, though all stock was charged into process at both actual and standard.

Material in Process

The accounts for material in process, with their balances as of August 1, 19—, were those numbered 12 to 15, inclusive, in the trial balance.

Labor and Expense in Process

The debit side of the account for total labor and expense in process, Account 16 in the trial balance as it appeared on August 1, 19—, was ruled as follows in the ledger itself, page 391.

Thus the labor and expense balances were separately known, with both actual and standard in each case. Similar columns were provided on the credit side of the account.

Finished Goods

Accounts were kept for finished goods by grades (types) of product. Information for different sizes within these grades could be found on the inventory control cards for finished goods. To simplify the work in this case, all finished goods are recorded in one account, the balance on August 1, 19—, being shown in Account 17 in the trial balance.

General Ledger Control

As has been indicated, this account was debited or credited for all transactions affecting both the general ledger and the cost ledger. It contained figures for actual cost only, and the balance standing on the credit side of this account at the end of any accounting period agreed with the total actual value of all the inventories, as will be seen from Item 18 in the trial balance.

Standard Cost Control

An account entitled Standard Cost Control was kept in the cost ledger for the purpose of keeping the standard costs in balance, thus providing a check on their accuracy. The balance standing on the credit side of this account agreed with

Total Labor and Expense in Process

Debit											
Labor				Expense				Total			
F	Actual	Standard	Ratio	*F*	Actual	Standard	Ratio	*F*	Actual	Standard	Ratio
Balance	$8,002.60	$9,073.56		Balance	$9,786.96	$10,000.43			$17,789.56	$19,073.99	

the total of all the standard cost debits in those accounts which contained them.

Other Accounts in the Cost Ledger

Below is given a list of all the other accounts in the cost ledger, additional to those given above in the trial balance. Some of these accounts had special columnar rulings, which will be illustrated and explained later, as occasion for the use of them arises.

Cotton Beaming—Controllable Expense
Winding —Controllable Expense
Setting —Controllable Expense
Threading —Controllable Expense
Weaving —Controllable Expense
Finishing —Controllable Expense
Mill General —Controllable Expense
Noncontrollable Expense
Cost of Goods Sold
Loss on Seconds Produced

JOURNAL VOUCHER

No.
Prepared by__________Approved by__________Date
Description Entered

Account	*F*	Cost ledger			
		Debit		Credit	
		Actual	Standard	Actual	Standard

of the month and formed a journal for the cost department. The heading of a journal voucher is given on page 392. It is suggested that for purposes of the problem the student enter the transactions on columnar paper similarly ruled, using the column headings as in the journal voucher.

Journalize the following transactions, and post them to ledger accounts as shown:

Summary of Transactions

Materials Purchased

At the close of each month the accounts payable department in the general accounting office prepared for the cost department a journal voucher, covering purchases of material and compiled from a voucher register distribution sheet. Purchases for the month of August were as follows:

	Actual
Jute Yarn Stock	$83,688.83
Binding Materials Stock	598.94
Packing and Baling Materials Stock	6,734.99
General Factory Supplies	12,212.61
Repair Materials Stock	6,816.02
Undistributed Freight	864.48
Minor Supplies Stores	854.17

Raw Materials Transferred to Work in Process

Raw materials were issued into process on the basis of material requisitions, which the material control department priced at both actual and standard cost. The summary of these for the month of August was as follows:

	Actual	Standard
Axminster Colored Yarn Stock	$45,402.48	$80,616.50
Cotton Yarn Stock	16,970.37	30,462 33
Jute Yarn Stock	18,094.80	28,233.09
Finishing Materials:		
Binding Materials Stock	137.92	175.72
Packing and Baling Materials Stock	1,819.50	2,334.58
Fringe Stock	632.72	831.43

Direct Labor Cost—Actual

A considerable amount of information was gathered on direct labor and other types of expense and presented to foremen and executives in the form of reports, The summary for the cost ledger of direct labor expense by departments for the month of August was as follows:

	Actual
Cotton Beaming	$ 182.00
Winding	944.19
Setting	3,925.69
Threading	435.97
Weaving	7,677.42
Finishing	2,798.11

Enter the foregoing labor charges in departmental labor and expense accounts ruled like the Total Labor and Expense account shown on page 391.

Departmental Controllable Expense—Actual

Overhead was divided into controllable items, such as supervision and indirect labor, and noncontrollable items, such as depreciation and insurance. The names of these accounts have been given on page 392. These ledger accounts were ruled into columns, each column containing a classification of controllable expense applicable to the given department. A *pro forma* ledger account for the controllable items in the winding department is illustrated on page 395; for other departments additional column headings may be needed.

Controllable items of overhead were posted to these accounts; later the amounts absorbed by current production were credited here and charged to the departmental labor and expense in process accounts, from which a final transfer was made to the total labor and expense in process account.

The payroll department furnished the following information concerning the controllable expense items:

Supervision	Actual
Cotton Beaming	$ 95.97
Winding	86.12
Setting	200.91
Threading	134.99
Weaving	344.07
Finishing	164.64
Mill General	823.05
Indirect Labor	**Actual**
Winding	$ 81.86
Setting	477.05
Threading	85.79
Weaving	2,641.69
Finishing	989.59
Mill General	951.75
Repairs and Maintenance Labor	**Actual**
Weaving	$ 88.56

Department—Winding Account—Controllable Expense

Debits														Credit	
Supervision		Indirect labor		Repairs and maintenance		Experimental		Supplies		Sundry expense		Total			
F	Actual	*F*	Actual	*F*	Actual	*F*	Actual	*F*	Actual	*F*	Actual	*F*	Actual	*F*	Amount

The payroll department also reported payment of a superintendent's and foremen's bonus of $24.80 during the month of August, to be charged to the Mill General account.

Miscellaneous Materials Used—Actual

The material control department summarized these for the month:

General Factory Supplies Used	Actual
Cotton Beaming	$ 0.25
Winding	4.33
Setting	34.62
Weaving	454.68
Finishing	355.45
Sizing Materials	895.60
Mill General	56.66
Total	$1,801.59

Repair Materials Used	Actual
Cotton Beaming	$ 0.41
Winding	0.07
Setting	34.19
Weaving	343.84
Finishing	43.93
Mill General	42.97
Total	$ 465.41

Minor Supplies Stores Used	Actual
Mill General	$ 99.00

Service Departments

Certain departments were maintained to perform services for all of the mills. At the close of each month the general accounting office summarized the charges to each mill for such services, including charges to the Axminster mill as follows (debit departmental controllable expense accounts, credit General Ledger Control):

General Factory Mechanics Labor and Expense	Actual
Cotton Beaming (Repairs and Maintenance)	$ 2.94
Winding (Repairs and Maintenance)	20.95
Setting (Repairs and Maintenance)	238.51
Threading (Repairs and Maintenance)	5.51
Weaving (Repairs and Maintenance)	714.05
Finishing (Repairs and Maintenance)	54.40
Mill General (Repairs and Maintenance)	131.20
Automobile Trucking	
Mill General (Sundry Expense)	$ 320.75
Designers and Colorists	
Mill General (Designing and Coloring)	$5,531.70
Addressograph Department	
Mill General (Sundry Expense)	$ 6.18

Works Orders	
Weaving (Repairs and Maintenance)	$ 284.81
Finishing (Repairs and Maintenance)	68.80
Manufacture of certain parts for repairs	
Yard Gang Expense	
Mill General (Sundry Expense)	$ 42.00
Total	$7,421.80

Royalties on Threading Equipment

Threading equipment was rented on a royalty basis. The cost ledger credit for this entry should be to General Ledger Control, and the debit to a Royalties column in Threading account.

	Actual
Threading (Royalties)	$270.83
Distribution of Freight	
Mill General (Sundry Expense)	
Credit Undistributed Freight	$ 73.46

Noncontrollable Items of Overhead

Various items of overhead were classified as noncontrollable since they did not vary directly with the volume of production. These items were grouped under the classifications shown in the diagram, page 388. An account for each classification was maintained in the general ledger; thus in the case of Power and Light the debits to the general ledger account included an outside power and light bill as well as the cost of producing power and light by the company's own power house. Balances remaining in service department accounts at the close of a period were closed to General Plant Expense.

After these costs were accumulated in general ledger accounts, they were allocated to the several mills on the usual bases.

An account in columnar form, for noncontrollable items of expense, was maintained in the cost ledger of the Axminster mill, with a column for each classification of noncontrollable expense and a final column for credits to the account. Departmental accounts were not provided for noncontrollable items. The costs were first collected by columns in the one noncontrollable expense account, from which transfers were later made to the departmental labor and expense in process accounts.

The amounts allocated to the Axminster mill for noncontrollable items of expense were as follows (Credit General Ledger Control):

Compensation Insurance		$ 293.30
Power and Light		716.00
Heat and Steam		1,629.86
Fixed Expenses:		
Depreciation	$12,497.38	
Taxes	1,342.65	
Insurance	240.72	14,080.75
General Plant Expense		3,213.10

Normal Expense Absorbed

It was the practice of the company to charge the departmental labor and expense in process accounts only for the amounts of the overhead absorbed by actual operations during the period. The charges were calculated by multiplying the number of machine hours operated by each machine or group of machines, or the standard labor dollars of a department, by the overhead rates set up in the annual manufacturing expense budget for each department. Though these charges represented the amount of overhead absorbed at normal rates, they were entered as debits in the Actual column for expense in the departmental process accounts, since they were calculated from actual hours operated or labor dollars paid. The credits corresponding to these debits were to the controllable and noncontrollable expense accounts and were determined by applying budget percentages to the amounts absorbed by each department. The following illustration shows the method of calculating these credits; the figures are illustrative only and do not apply to the figures used in the case problem.

Budget Percentages (Direct Departments)[1]

Department	Controllable Expense, per cent	Noncontrollable expense				Total, per cent
		Power and Light, per cent	Heat and Steam, per cent	Fixed Charges, per cent	General Plant Expense, per cent	
1	60	10	5	15	10	100
2	45	15	20	10	10	100
3	65	5	..	15	15	100
4	50	10	10	10	20	100
5	50	10	20	10	10	100

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[1] Illustrative only.

EXPENSE ABSORBED[1]

1	$ 30,000	$ 5,000	$ 2,500	$ 7,500	$ 5,000	$ 50,000
2	27,000	9,000	12,000	6,000	6,000	60,000
3	52,000	4,000		12,000	12,000	80,000
4	30,000	6,000	6,000	6,000	12,000	60,000
5	50,000	10,000	20,000	10,000	10,000	100,000
Total.......	$189,000	$34,000	$40,500	$41,500	$45,000	$350,000

[1] Illustrative only.

JOURNAL ENTRY[1]

Process accounts:		
Department 1	$ 50,000	
2	60,000	
3	80,000	
4	60,000	
5	100,000	
To Controllable Expense:		
Department 1		$ 30,000
2		27,000
3		52,000
4		30,000
5		50,000
To Noncontrollable Expense:		
Power and Light		34,000
Heat and Steam		40,500
Fixed Charges		41,500
General Plant Expense		45,000
Total	$350.000	$350,000

[1] Illustrative only.

The journal entry for expense absorbed by operations in the Axminster mill during August was as follows:

Charges to departmental labor and expense in process accounts, Actual column:

Cotton Beaming	$ 213.81
Winding	252.12
Setting	2,952.80
Threading	681.76
Weaving	10,651.40
Finishing	4,424.91

Credits to controllable expense accounts:

Cotton Beaming	$ 109.04
Winding	118.50
Setting	1,358.29
Threading	340.88
Weaving	4,473.58
Finishing	2,212.46
Mill General	1,564.35

Credit to noncontrollable expense:

Power	$ 521.33		
Heat	591.04		
Fixed	6,003.75		
General	1,474.44		
Compensation Insurance	409.14		8,999.70
Total		$19,176.80	$19,176.80

Unabsorbed Overhead

Balances left in the controllable and noncontrollable expense accounts, after the foregoing postings, represented unabsorbed or overabsorbed expense. These were closed to a cost ledger account entitled Cost of Goods Sold. If the student's work has been correct to this point, the credits necessary to close these accounts should be as follows:

		Credit
Noncontrollable Expense Account		$10,933.31
Cotton Beaming	—Controllable Expense	9.47*
Winding	—Controllable Expense	74.83
Setting	—Controllable Expense	373.01*
Threading	—Controllable Expense	156.24
Weaving	—Controllable Expense	398.12
Finishing	—Controllable Expense	359.95
Mill General	—Controllable Expense	6,539.17

* Red—representing debits to be entered in red ink in the credit columns of the accounts affected.

Standard Cost of Departmental Production

Up to this point the departmental labor and expense in process accounts have been charged with actual labor cost and with expense absorbed. It is now necessary to determine the standard costs of departmental production, which are to be debited in the Standard columns of the Work in Process accounts.

Production reports prepared each month showed the production, in units, of each department. These quantities were then priced at unit standard labor costs and unit standard expense costs as shown in the standard cost files. The calculation of the standard labor cost and standard expense cost for the production of the cotton beaming department is illustrated on page 401.

STANDARD COST OF DEPARTMENTAL PRODUCTION

Sheet 1 of Axminster

Department—Axminster Beaming   Month Ending, August 31, 19—

Description	Quantity, beams	Unit cost		Total cost		Total labor and expense
		Labor	Expense	Labor	Expense	
Beaming:						
27 in. 190 pitch...	117	33.5¢	18.8¢	$ 39.20	$ 22.00	
378 pitch...	93	20.0	11.2	18.60	10.42	
45 in. 315 pitch...	15	48.5	23.9	7.28	3.59	
630 pitch...	22	28.5	13.9	6.27	3.06	
54 in. 379 pitch...	30	49.5	24.3	14.85	7.29	
756 pitch...	100	29.0	14.1	29.00	14.10	
63 in. 882 pitch...	6	31.5	15.5	1.89	.93	
72 in. 1008 pitch...	7	32.0	15.7	2.24	1.10	
Section beaming:						
94 ends....	151	47.0	66.6	70.97	100.57	
100 ends....	74	44.0	62.3	32.56	46.10	
Totals............	...	.....	.....	$222.86	$209.16	$432.02

The standard cost of departmental production for the month of August was as follows (credit Standard Cost Control for total):

Standard Cost Debit to Departmental Labor and Expense in Process accounts:

Cotton Beaming, Labor	$ 222.86
Expense	209.16
Winding, Labor	1,125.60
Expense	281.40
Setting, Labor	4,644.23
Expense	2,910.44
Threading, Labor	490.84
Expense	530.62
Weaving, Labor	9,003.76
Expense	12,322.82
Finishing, Labor	2,869.59
Expense	4,424.91

Trial Orders

In addition to the regular production, for which standard costs were figured as above, various pieces of goods were run through the mill as trial samples of new designs or construction. Material used in these samples was priced by the inventory control department. The payroll department kept a record of labor expanded on samples, and overhead was added in proportion to the labor (dollars). The cost of this production was deducted from the process accounts by entries in red on the debit side of the accounts. The reason for this was to avoid distortion of the ratio between standard and actual, which was computed from the debit side.

The expense for trial samples during August was as follows (debit General Ledger Control for total actual cost and debit Standard Cost Control for total standard cost):

	Actual	Standard
Setting, Labor	$ 0.57*	
Expense	1.24*	
Weaving, Labor	17.37*	
Expense	16.23*	
Surface Yarn in Process	0.21*	$0.31*
Cotton Yarn in Process	0.03*	0.05*
Jute in Process	0.05*	0.08*

* Red on the debit side.

Adjustment for Number of Rugs per Set

A standard yield of rugs from a given set of spools was one of the elements in the standard costs. The actual yield usually varied from the standard yield due to spoilage and variations in weaving. If two sets of spools having the same length of yarn are used to produce the same type and size of rugs, and the first set produces a standard yield of 500 rugs while the second set produces 508 rugs, the actual cost per rug in the second set is less than the actual cost per rug in the first set. This would result from the fact that a greater quantity of rugs was produced from the same length of yarn materials and the same labor and expense in winding this yarn, setting it on spools, and threading the spools. The cost of cotton beaming material used, jute used, weaving and finishing per rug was adjusted by a method discussed in the next section of this case.

The yield per set could not be accurately determined until the material on the spools had been exhausted in production, which might take six weeks and extend over three accounting periods. The first rugs from a set of spools might be finished and sold before the last rugs from that set were produced. It was necessary to arrive at a cost for the products completed during a period without knowing the actual yield per set, and to make an adjustment later when that factor was known. Thus the current cost ratios were used without an allowance for yield, though these ratios included a standard allowance based on previous yield adjustments.

Production records gave the yield of each set upon completion, and at the close of each month the yield above or below standard for each set completed was priced at standard cost, by reference to the standard cost files, and priced at actual cost by applying the cost ratios developed at the close of the previous month for surface yarn in process and for labor and expense in process in the winding, setting, and threading departments.

A journal entry was then prepared to increase the actual cost of finished stock if the yield had been below standard and to decrease it if the yield had been above standard. Contra entries were made to the process accounts. The standard cost of the finished stock was, of course, unaffected by the actual yield. The standard cost of the processing departments was affected, however, because this material was still in process and had to show a standard cost as well as an actual cost.

The rugs per set adjustment for sets completed during August is given below. Notice that the net adjustment to finished stock is a credit, and the process accounts are debited, indicating that the average actual yield was above standard yield, and thus reduced the actual cost of goods finished below standard cost:

	Debit	
	Actual	Standard
Surface Yarn in Process	$594.41	$ 872.85
Labor and Expense in Process:		
Winding, Labor	11.04	13.03
Expense	2.73	3.49
Setting, Labor	52.63	61.55
Expense	41.62	38.47
Threading, Labor	6.06	6.88
Expense	9.31	7.53
Finished Goods†	717.80*	
Standard Cost Control		1,003.80*

* Red.

† This item applied to different types of rugs as shown below. The figures are presented to illustrate how some of the sets finished had a yield below standard, though the total was better than standard.

Rug	Debit Actual
A	$ 10.58
B	79.98*
C	33.92*
D	32.51*
E	30.48*
F	29.26*
G	2.48*
H	307.26*
I	39.86
J	43.96
K	60.56
L	128.29*
M	14.77*
N	4.77*

* Red.

Adjustment for Invisible Loss in Process

Though the yield per set could not be determined until a set was completed, an adjustment could be made to the process accounts for variations between the actual and standard weight of products finished during the month. Such a variance, for example, might occur with surface yarn; although a standard length might be used in a rug, the weight of the yarn might vary. These variations were determined by using laboratory test reports to obtain the average actual weight of products manufactured during the month. The variations were then priced by reference to the standard cost files.

This adjustment for the month of August was as follows:

Total Labor and Expense in Process (Standard)	$ 831.98*
Surface Yarn in Process (Standard)	1,609.16*
Cotton Yarn in Process (Standard)	309.87*
Jute in Process (Standard)	502.38*
Finishing Materials in Process (Standard)	79.41*
Standard Cost Control (Debit)	$3,332.80

* Red on debit side.

The result of this adjustment is that work in process is now correctly priced at standard, to carry forward to next period. It will later be seen also that the ratios between actual and standard cost will be higher, so that when the finished production is priced, the actual cost will be higher, indicating that the average yield per pound of material was below standard.

Adjustment for Incorrect Pricing in Previous Month

	Standard
Standard Cost Control (Debit)	$3,430.03
Surface Yarn in Process	3,430.03*

* Red on debit side.

Transfer of Departmental Labor and Expense to Total Account

After all labor and expense had been entered in the departmental accounts, the balances were transferred to the total account. The amounts transferred at the close of August were as follows:

	Debit		Credit	
	Actual	Standard	Actual	Standard
Total Account, Labor	$16,015.17	$18,438.34		
Expense	19,212.99	20,728.84		
Cotton Beaming, Labor			$ 182.00	$ 222.86
Expense			213.81	209.16
Winding, Labor			955.23	1,138.63
Expense			254.85	284.89
Setting, Labor			3,977.75	4,705.78
Expense			2,993.18	2,948.91
Threading, Labor			442.03	497.72
Expense			691.07	538.15
Weaving, Labor			7,660.05	9,003.76
Expense			10,635.17	12,322.82
Finishing, Labor			2,798.11	2,869.59
Expense			4,424.91	4,424.91

Pricing Waste Recovered

Waste was priced at its actual salvage value and at the standard cost at which the material was originally charged to the process accounts. The salvage value was debited to the miscellaneous waste stock account and the standard value was debited to Standard Cost Control. The amounts were deducted from the materials in process accounts concerned, by entering them in red on the debit side so the current ratio would take account of this cost. The journal entry to record the waste adjustment for August was as follows:

	Debit	
	Actual	Standard
Miscellaneous Waste Stock, Debit	$647.28	
Standard Cost Control, Debit		$5,016.42
Surface Yarn in Process, Credit	647.28*	5,016.42*

* **Red on debit side.**

Surface Yarn Returned to Stock

The following journal entry covered the return of some surface yarn from the process account to the raw material inventory account, being good materials not needed at the time.

	Debit	
	Actual	Standard
Axminster Colored Yarn Stock.................	$638.09	$1,066.73
Surface Yarn in Process.......................	638.09*	1,066.73*

* Red on debit side.

Computation of Ratios

All the debits, standard and actual, have now been entered in the process accounts, as well as the deductions from these debits for various purposes. The ratios should now be computed, by expressing the actual costs as ratios of the standards. Calculate these ratios to three decimal places, ignoring subsequent fractions. This is done in the following accounts:

Surface Yarn in Process.
Cotton Yarn in Process.
Jute in Process.
Finishing Materials in Process.
Total Labor and Expense in Process.

Standard Cost of Goods Finished

During the month analysis sheets were prepared for the rug sizes within each weave, with unit standard costs ready for extending. When the quantities produced were known at the end of the month, they were inserted on the analysis sheets and the extensions were made to arrive at the standard cost of the entire production for each weave of rug.

The analysis sheet covering the standard cost of production for one type of rug is illustrated on page 407.

Actual Cost of Goods Finished

After the standard cost of production was determined, the actual cost was obtained by applying to the standard costs the

Analysis Sheet—Transfers to Finished Stock—Standard Cost, August 19—

a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*	*m*	*n*	*o*	*p*
Size	Quantity	Wool	Pounds	Yarn cost		Cotton cost		Jute cost		Finishing material		Labor and expense		Other cost	Total
President															
27 × 52	103	1.094	113	0.357	$ 36.77	$0.131	$ 13.49	$0.208	$ 21.42			$0.294	$ 30.28		
36 × 63		1.767		0.575		0.210		0.331				0.368			
4.6 × 6.6		3.282		1.068		0.383		0.605		$0.119		1.055			
6 × 9	199	6.059	1,206	1.973	392.63	0.692	137.71	1.094	217.71	0.153	$ 30.45	1.650	328.35		
7.6 × 9	196	7.574	1,485	2.465	483.14	0.866	169.74	1.368	268.13	0.182	35.67	1.969	385.92		
8.3 × 10.6	164	9.719	1,594	3.163	518.73	1.103	180.89	1.742	285.69	0.203	33.29	2.277	373.43		
9 × 12	273	12.120	3,309	3.944	1,076.71	1.356	372.92	2.157	588.86	0.223	60.88	2.674	730.00		
2.3 × 9	50	2.272	114	0.740	37.00	0.256	12.80	.660	33.00			0.529	26.45		
2.3 × 12	49	3.029	148	0.986	48.31	0.341	16.71	.881	43.17			0.676	33.12		
Grade total.......	......		7,969		$2,593.29		$904.26		$1,457.98		$160.29		$1,907.55	$4,430.08	$7,023.37

Explanation

a = size of rugs.
b = number of rugs finished during the month.
c = standard number of pounds of wool in each size of rug.
$d = b \times c$.
e = standard cost of yarn per rug.
$f = b \times e$.
g = standard cost of cotton per rug.
$h = b \times g$.
i = standard cost of jute per rug.
$j = b \times i$.
k = standard cost of finishing materials per rug.
$l = b \times k$.
m = standard cost of labor and expense per rug.
$n = b \times m$.
$o = h + j + l + n$.
$p = o + f$.

current cost ratios already computed. The actual and standard costs of production were then credited to the respective process accounts and finished goods accounts were debited.

Cost of Seconds

Seconds reported in production were first priced at full cost on the analysis sheets in order to obtain the correct credits to the process accounts. After the credits were determined, seconds were repriced at a reduced cost sufficient to maintain the normal gross profit margin on their sale at lower selling prices. The values thus arrived at were set up as debits to the finished stock accounts, the difference between the costs credited to the process accounts and the costs debited to the finished stock accounts being considered as additional manufacturing cost for the period, to be carried to a separate account, Loss on Seconds Produced. Thus the loss on seconds was taken during the period in which they were produced and the period in which they were sold was given the opportunity, as far as costs were concerned, of realizing the normal gross profit margin on their sale. Loss on Seconds Produced was later closed into Cost of Goods Sold.

Transfer to Finished Goods

The journal entry given below shows the total debits, both actual and standard, to the finished goods account. As has been indicated, finished goods are treated in total in this case, though actually the company maintained a separate account for each type of rug. A debit (actual) is given also for the cost of seconds produced and a debit (standard) to remove the standard cost of seconds produced from the standard control account. Credits are given for the standard cost of finished goods transferred from the process accounts. Calculate the credits for the actual cost by applying the ratios between standard cost and actual cost which were computed on the debit side of the process accounts to the standard credits given in this journal entry. If the work has been correct, the debits and credits in the journal entry should balance.

Samples Shipped to Sales Points

Each month a number of samples of finished goods were sent to territorial sales offices. These were credited out of the

	Debit		Credit	
	Actual	Standard	Actual	Standard
Finished Goods.......	$116,427.84	$162,931.61		
Loss on Seconds Produced...........	1,884.10			
Standard Cost Control		2,647.38		
Surface Yarn in Process				$ 80,458.21
Cotton Yarn in Process				15,493.31
Jute in Process.......				25,119.06
Finishing Materials in Process..........				2,909.34
Total Labor and Expense in Process..				41,599.07
Totals.............	$118,311.94	$165,578.99		$165,578.99

finished stock accounts and transferred to the general ledger, in which they were treated as a selling expense.

Samples shipped to territories during August were as follows:

	Debit		Credit	
	Actual	Standard	Actual	Standard
General Ledger Control....	$219.68			
Standard Cost Control.....		$303.81		
Finished Stock............			$219.68	$303.81

Cost of Sales

Goods shipped out of finished stock were priced at actual and standard cost as shown on perpetual inventory cards. The total actual and standard values for goods sold during August was as follows:

	Debit		Credit	
	Actual	Standard	Actual	Standard
Cost of Goods Sold....	$340,592.18			
Standard Cost Control		$475,579.85		
Finished Stock........			$340,592.18	$475,579.85

In addition the Loss on Seconds balance should be closed into Cost of Goods Sold at this point.

Transfer of Cost of Sales to General Ledger

The balance in the Cost of Sales account was transferred to the general ledger at the close of the month, thus completing the work in the cost ledger for the period.

	Actual	
General Ledger Control	$360,555.42	
Cost of Sales		$360,555.42

Take a trial balance of the cost ledger, with actual and standard columns on both the debit and credit sides.

PART IV

SOME SPECIAL PHASES OF COST WORK

XXII

MACHINES IN COST ACCOUNTING

Necessity of Mechanical Aids

In the modern business office labor-saving machinery is used to almost as great an extent as in the modern factory; no business man would think of doing without it in either place. In the office there may be some question as to which particular type or make of machine is to be preferred for a given purpose, but there can be no question about the general desirability of using some mechanical equipment. The cost of clerical help in these days does not permit of clerks' spending a large part of their time doing purely arithmetical operations which a machine can do more quickly and more accurately. And these are not the only advantages; a business which lets its clerks do all the necessary calculations without mechanical help will find that the clerks themselves will tend to become mere mechanical calculators. They will not be free to devote their minds to an intelligent understanding and presentation of the cost data, and the management will not get the best results from its cost department. A great deal of routine work would be likely to be done to no particular purpose.

Specific makes of machines cannot, of course, be referred to in a work like this, but a general review of the different types of machines and the operations which they perform will be of assistance to the student of cost accounting.

Adding and Calculating Machines

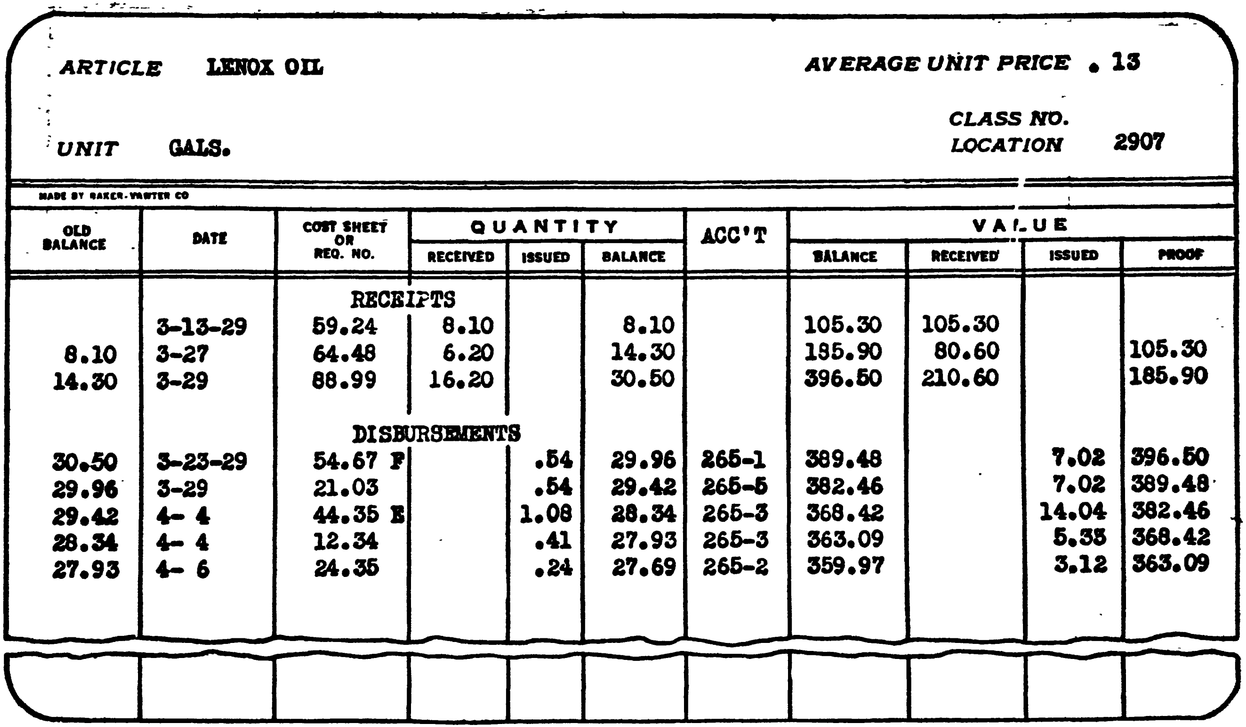
The most generally used office machines, after the typewriter, are probably the adding and calculating machines. The former are of two main types: those which provide a printed list of the items to be added, and those which do not but only accumulate a total which is displayed on the machine. The great advantage of the listing machine is the opportunity it provides for checking the items back or handling them in any other way. In fact the adding machine list is often filed with the list of items itself, as part of the permanent record, to show it has been checked in that way. If this printed list of items is not required, many men prefer to have something more than the simple adding machine and acquire a calculating machine, which will perform all the principal arithmetical operations and do them very quickly. While the operation of the calculating machine is somewhat more difficult to learn, its greater range of usefulness is apparent and has led to its displacing the adding machine in some cases; in an office handling a great volume of work both may be used to advantage. The cost accountant may also profit from knowing how to use the slide rule, which, though it will scarcely give accurate results beyond three digits, is very helpful in computing percentages, unit costs, or in rough-checking figures which have been otherwise computed.

Bookkeeping and Billing Machines

The machines which have been developed to keep accounts by debit and credit, and which are capable of making additions and subtractions and showing a resulting balance, are more appropriate in general accounting than in cost accounting. Their special advantage in bookkeeping arises from the possibility which most of them offer of making two or more records at once; thus it is common for journalizing and posting records to be made in one operation, with perhaps a customer's statement, or some other desired record, at the same time. But their ability to figure and show a remaining balance, after addition or subtraction, also makes them especially useful in keeping stock records for perpetual inventories; quantities received and issued can be combined with a quantity on hand at the beginning to show a final balance, and the same thing may be done with money values. Form 82 is an example of an inventory record prepared on a machine of this type.

Time Recording Devices

Time clocks of some form are universally considered necessary in the factory. There is a great variety of these, some of them contributing considerably to the manufacturing records for labor and burden, but they may be divided into two main groups; the first group includes the time clocks kept at the gate, and there used to record the in and out times of the employees; the second group includes the clocks used in the shops for



ARTICLE LENOX OIL

AVERAGE UNIT PRICE .13

CLASS NO.

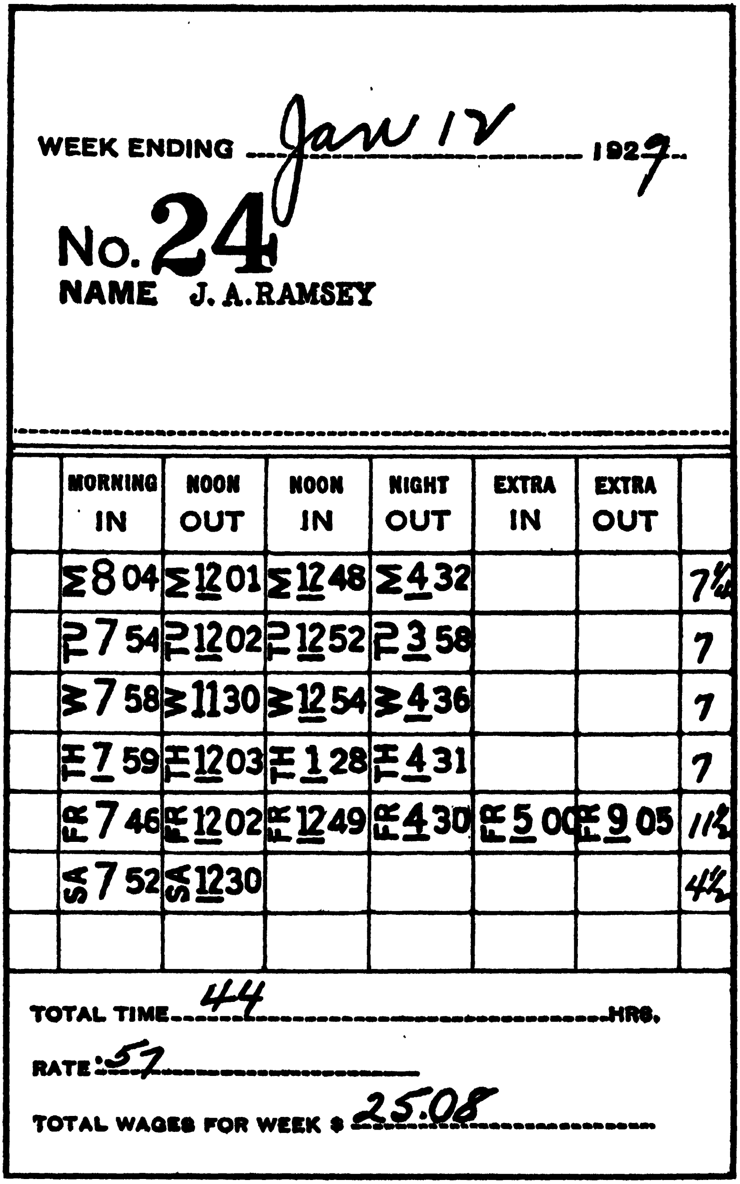
UNIT GALS.

LOCATION 2907

MADE BY BAKER-VAWTER CO

OLD BALANCE	DATE	COST SHEET OR REQ. NO.	QUANTITY			ACC'T	VALUE			
			RECEIVED	ISSUED	BALANCE		BALANCE	RECEIVED	ISSUED	PROOF
		RECEIPTS								
	3-13-29	59.24	8.10		8.10		105.30	105.30		
8.10	3-27	64.48	6.20		14.30		185.90	80.60		105.30
14.30	3-29	88.99	16.20		30.50		396.50	210.60		185.90
		DISBURSEMENTS								
30.50	3-23-29	54.67 F		.54	29.96	265-1	389.48		7.02	396.50
29.96	3-29	21.03		.54	29.42	265-5	382.46		7.02	389.48
29.42	4- 4	44.35 E		1.08	28.34	265-3	368.42		14.04	382.46
28.34	4- 4	12.34		.41	27.93	265-3	363.09		5.33	368.42
27.93	4- 6	24.35		.24	27.69	265-2	359.97		3.12	363.09

Form 82: Inventory record made on bookkeeping machine.



WEEK ENDING Jan 17 1927

No. 24

NAME J. A. RAMSEY

	MORNING IN	NOON OUT	NOON IN	NIGHT OUT	EXTRA IN	EXTRA OUT	
	M 8 04	M 12 01	M 12 48	M 4 32			7¼
	TU 7 54	TU 12 02	TU 12 52	TU 3 58			7
	W 7 58	W 11 30	W 12 54	W 4 36			7
	TH 7 59	TH 12 03	TH 1 28	TH 4 31			7
	FR 7 46	FR 12 02	FR 12 49	FR 4 30	FR 5 00	FR 9 05	11½
	SA 7 52	SA 12 30					4½

TOTAL TIME 44 HRS.

RATE .57

TOTAL WAGES FOR WEEK $ 25.08

Form 83: Individual in and out record—one week.

PAY ROLL WEEK ENDING March 26. 1922.

NAMES									Total Time	Rate	Amount Due
Geo Baerns	1	646 1201 1250 501	647 1204 1249 402	654 1201 1254 504	654 1207 1259 502	653 1203 1253 503 529 801	651 1202 1254 503		53	23	12 24
Wm Baker	2	647 1032 1252 504	658 1203 1252 503	653 1206 1258 502	656 1202 1254 507	652 1204 1252 502	656 1204 1256 502		52½	24	12 60
E.Q. Pope	3	644 1202 1257 502	655 1201 1259 505	655 1203 100 501 901 501	657 1206 1253 504	654 1202 1258 504	651 1201 1251 501		56	23	12 88
H. Emmer	4	655 1207 1250 303	648 1202 1253 506 529 731	649 1204 1244 503	652 1205 1248 503 532 800	651 1201 1257 506	659 1203 1258 232		54	32	17 28
J.C. Updike	5	653 1100 1252 501	652 1203 1256 504	654 1202 1252 502	652 1202 1251 502	656 1206 1254 503	650 1206 100 503		53	18	9 54
C.J. Weiser	6	649 1205 1257 502	654 1207 100 502	652 1200 1258 505	641 1000 100 501	643 1202 1251 404	647 1203 1259 502	653 1204 1248 503	59½	21	12 51
Chas Boone	7	651 1202 1259 504	659 1204	651 1206 1259 507	654 1203 1256 505	652 1202 1258 502	653 1207 1252 506	659 1202 1254 500	57	20	11 40
Percy Post	8	700 1203 1253 505	653 1206 1245 501	646 1207 1256 506	643 1204 1255 504	654 1207 1256 501	650 1201 1247 501	656 1203 1253 503	58½	42	24 57
Frank Monroe	9	656 1206 1251 503	657 1201 1258 504	658 1204 100 500	657 1201 1247 503	1247 507			44	45	19 80
Ed Bixby	10	643 1204 1258 505	651 1204 1252 503	650 1203 1254 503	658 1202 1254 500	652 1203 1252 502	644 1200 1251 502		54	27	14 58
A.N. Kastor	11	652 1201 100 501	649 1203 1256 505	647 1200 1259 504	650 1200 1258 301	653 1202 1255 501	649 1202 100 301		50	30	15 00
Chas Huber	12	800 1203 1250 504	648 1206 1249 504	654 1205 1256 502	659 1205 1259 501	651 1204 1251 506	651 1204 1253 504		53	31	16 43
Eugene Parks	13	657 1202 100 506	654 1202 1250 332	657 1204 1255 505	654 1203 1252 507	658 1206 1258 504	653 1202 1250 501		53	19	9 98
T.W. Doolittle	14	655 1206 1255 505	653 1201 1259 502		653 1202 1257 504	646 1202 1259 507	652 1204 1252 401		44	23	10 12
Geo Decker	15	658 1204 1253 500	655 1204 1252 505	652 1206 1254 504	657 1201 1252 506	654 1200 1254 501	653 1203 1257 507		54	26	14 04
Thos Dobbs	16	655 1207 1259 503	656 1207 1258 506	645 1201 1248 507	651 1206 1248 502	653 1201 1249 502	651 1202 1255 504		51	36	18 36
N. Lincoln	17	658 1203 1257 502	653 1202 1250 504	656 1202		659 1206 1252 503	654 1202 1254 503		41	17	6 97
Ernest Daniels	18	706 1202 1253 507	652 1204 1257 501	659 1203 1254 501	658 1207 1259 503	650 1204 1254 502 529 732	656 1201 1252 502		55½	24	13 32
Sam Potts	19	652 1205 1252 503	654 1203 100 503	652 1204 1252 504	651 1202 1252 507	648 1203 1247 503	652 1206 1251 506		54	29	15 66
W.B. Evans	20	656 1201 1248 506	704 1206 1248 502	646 1205 1259 503	645 1204 1254 505	652 1202 1259 506	641 1207 1243 503		53½	31	16 59
W.S. Turner	21	654 1204 1251 505	652 1200 1252 503	701 1203 1247 506	656 1203 1251 502	652 1207 1252 501					
Art Brown	22	658 1200 1250 502	659 1203 1257 501	651 1207 1251 505	648 1205 1256 506	659 1203 1251 504					
G.J. Cook	23	654 1207 1252 505	700 1204 1258 507	658 1206 100 503	650 1204 1254 505						
John Rivers	24	706 1206 100 503	656 1031 1251 500	654 1204 1254 50							
Matt Broughton	25	659 1204 1258 501	653 1202 1259	1202 125							
N.D. Eldred	26	656 1202 1254									
	80						503		49½	31	15 35
	81						652 1203 1253 506		56½	19	10 74
	82						652 1204 1254 504		48	25	12 00
	83				652 120	653 1202 1256 502	653 1202 1259 509		52	26	13 52
	84				654 1201 1259 501	654 1204 1254 504	651 1201 1257 506		52½	28	14 70
	85		504	648 503	1256 505 529 800	649 1206 1258 503	656 1206 1252 502		51½	32	16 48
Wm Dickson	86	659 1204 1248 503	658 1202 1253 503	645 1201 1255 507	653 1202	658 1201 1259 502	654 1203 1256 506		50	19	9 50
R Downey	87	656 1206 1259 507	659 1201 100 502	651 1203 1254 501	1249 501		653 1202 1253 502		40	22	8 80
J Manier	88	650 1203 1252 503	652 1207 1259 503	700 1204 1248 506	654 1206 1257 502	654 1204 1254 503	645 1202 1247 433		53½	26	13 91
E Mendell	89	654 1201 1240 501	650 1206 1256 505	657 1207 1253 502	653 1201 1256 507	651 1207 1241 502	652 1204		50	29	14 50
E Neuman	90	658 1205 151 503	655 1203 1244 507	655 1202 1255 205	650 1202 1258 504	653 1202 1252 501	651 1202 1251 501		50	19	9 50
R.G. Starr	91	656 1202 1249 502	651 1204 1252 501	650 1201 1258 505	657 1100 1253 503	652 1201 1256 504	656 1201 1254 504		53	21	11 13
F Davis	92	652 1204 1258 501	655 1205 1251 504	652 1206 1256 502	656 1202 1254 504	646 1203 1253 502	654 1203 1253 503		54	23	12 42
A.E. Mead	93	652 1200 1251 503	655 1202 1254 502	654 1202 1252 504	652 1203 1252 503	652 1204 1251 507	659 1204 1253 507		54	27	14 58
A. Worden	94	757 1207 1250 500	654 1201 1255 505 529 701	652 1203 1254 502	658 1202 1253 506	654 1203 1254 501	658 1202 1259 502		54½	23	12 54
J.O. Bayer	95	649 1206 1259 502	658 1204 1256 504	656 1206 1256 506	657 1207 1257 502	653 1202	654 1201 1258 504		50	21	10 50
W.J. Clark	96	647 1201 100 505	649 1200 1254 503	657 1205 1259 504	653 1206 1256 503	656 1206 1253 504	652 1206 1252 401		53	17	9 01
O.G. Drury	97	654 1205 1249 503	654 1203 1246 505	659 1203 1247 501	654 1203 1252 504	657 1204	654 1207 1251 506		50	18	9 00
F.W. White	98	655 1203 1258 504	658 1204 1257 502	649 1207 1254 504	649 1201 1250 506	652 1203 1256 503	653 1202 1257 504		54	21	11 34
E. Attwell	99	659 1200 100 507	655 1206 100 506	659 1201 1252 502	651 1204 1251 502	653 1202 1252 506	651 1201 1254 502		54	20	10 80
F.H. Getz	100	654 1204 1257 502	651 1206 1255 501	654 1206 1252 506	656 1203 1253 431	659 1204 1254 501	653 1204 1252 503		53½	30	16 05
								TOTAL	4317½		1242.13

recording the starting and stopping times, and time taken, on specific jobs. Most companies continue to use both types of clock, and to check one record against the other; that is, the total number of hours spent on the premises by all employees, as shown by the gate record, should agree roughly with the total number of hours devoted to actual jobs, as shown by the job time records made in the shops. If any large discrepancy appears, a further investigation will of course be made in detail to ascertain the cause, and to find especially if any large amount of time is being wasted by men who are on the premises but are waiting for jobs.

In and Out Time Records

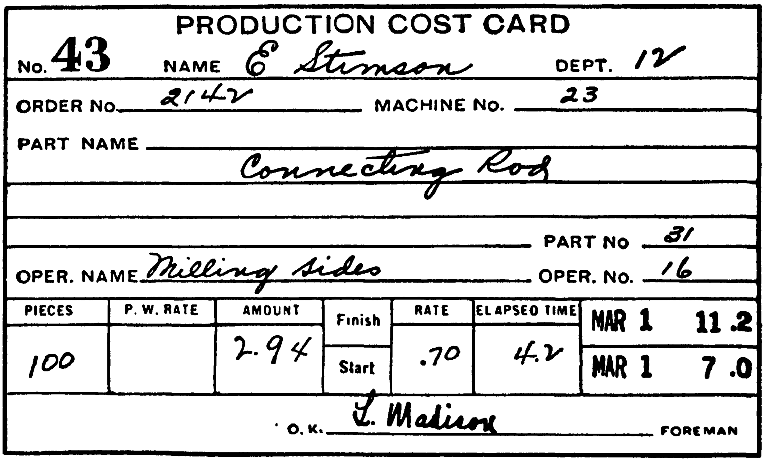
There are two main types of records used at the entrance to the plant for the purpose of showing the amount of time spent on the premises. The first is the individual record, using one card for each man, of which Form 83 is an example. These may be designed to cover one week or two weeks, and are arranged in different ways to suit different industries; in some cases space is provided to show burden information, when the latter is applied on a labor basis.

The other main type of record is the roll, on which the entire labor force may be listed. Here again a new roll may be provided for each day or one roll may cover a week, as in Form 84, or two weeks if that is the payroll period. These forms also may be set up with any arrangement desired by the business; it is common for columns to be provided for day work, piece work, bonus wages, lost time, and deductions; in these columns may be entered the amounts of wages due to each man as computed from the time recorded on the left side of the roll.

Job Time Records

Under this heading also two general types of record are found. The individual job card (Form 85) shows the starting and stopping times on a specific job, with spaces for the elapsed time, the rate, the amount of wages payable, and sometimes for the burden applicable to the job. In some cases the elapsed time itself may be figured and stamped by the clock, instead of being done by hand as in Form 85.

The other type of job record is illustrated in Form 86; it shows the time for an entire day, including the starting and stopping time on each job worked during the day; this is especially suitable where jobs are changed somewhat frequently during the day. Form 86 is often provided with an in-and-out record on the back, which may be checked against the job records shown on the face of the form.



PRODUCTION COST CARD

No. 43 NAME E Stimson DEPT. 12

ORDER No. 2142 MACHINE No. 23

PART NAME Connecting Rod

PART No 31

OPER. NAME Milling sides OPER. No. 16

PIECES	P. W. RATE	AMOUNT		RATE	ELAPSED TIME	
100		2.94	Finish	.70	4.2	MAR 1 11.2
			Start			MAR 1 7.0

O. K. L. Madison FOREMAN

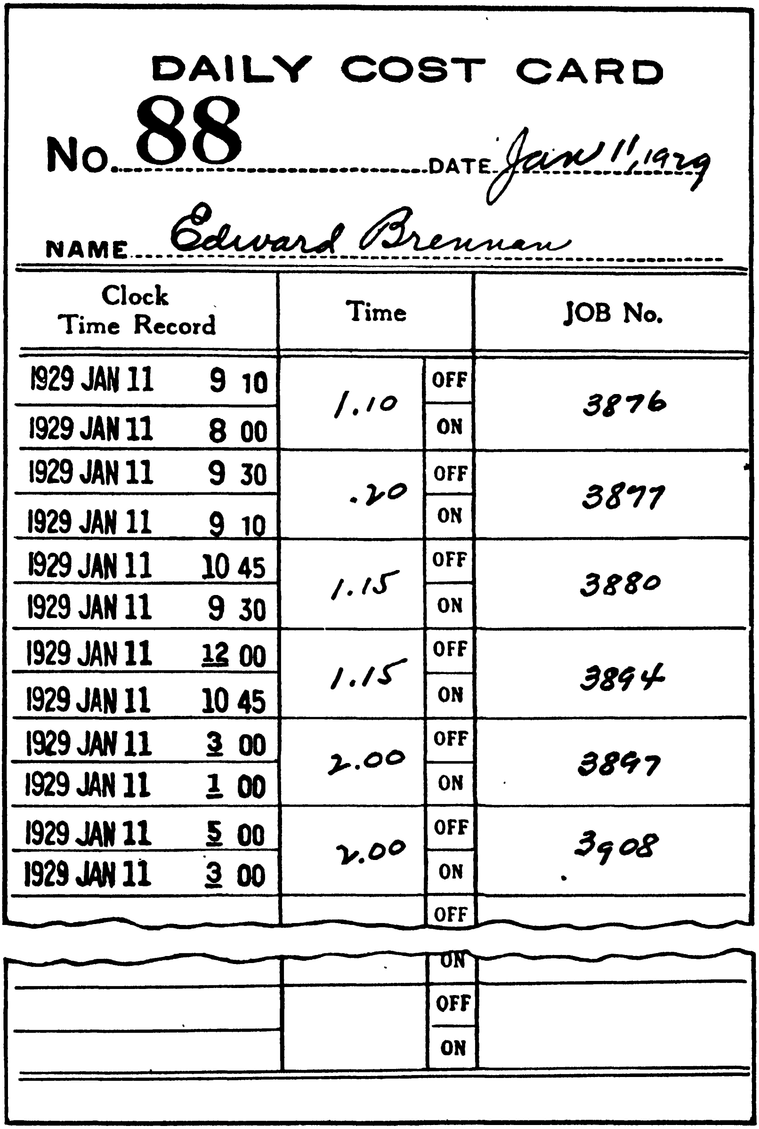
Form 85: Time record for one job.

Tabulating Equipment

The accounting in cost work has within the last ten years been revolutionized in many business offices by the adoption of tabulating equipment, which includes devices for making original records of information and also for distributing or analyzing these records in any manner required. In other words, the equipment effects substantially the same purposes as columnar journals, but the tabulating equipment effects the distributions and gives the totals with a facility and speed out of all proportion greater than can be obtained with columnar journals. Special adaptations of these machines and of the forms used with them have been worked out to suit practically all the common varieties of repetitive work in accounting and in cost accounting.

The original records used with tabulating equipment consist of cards similar to Form 87.

All information is reduced to a numerical basis such as account number, customer number, employee number, department number, and so on, after which these numbers and amounts are represented by holes punched in the cards in suitable positions. If Form 87 is closely observed, it will be seen that the information expressed in writing is reproduced in the punched part of the card. One such card is punched for each item or transaction.



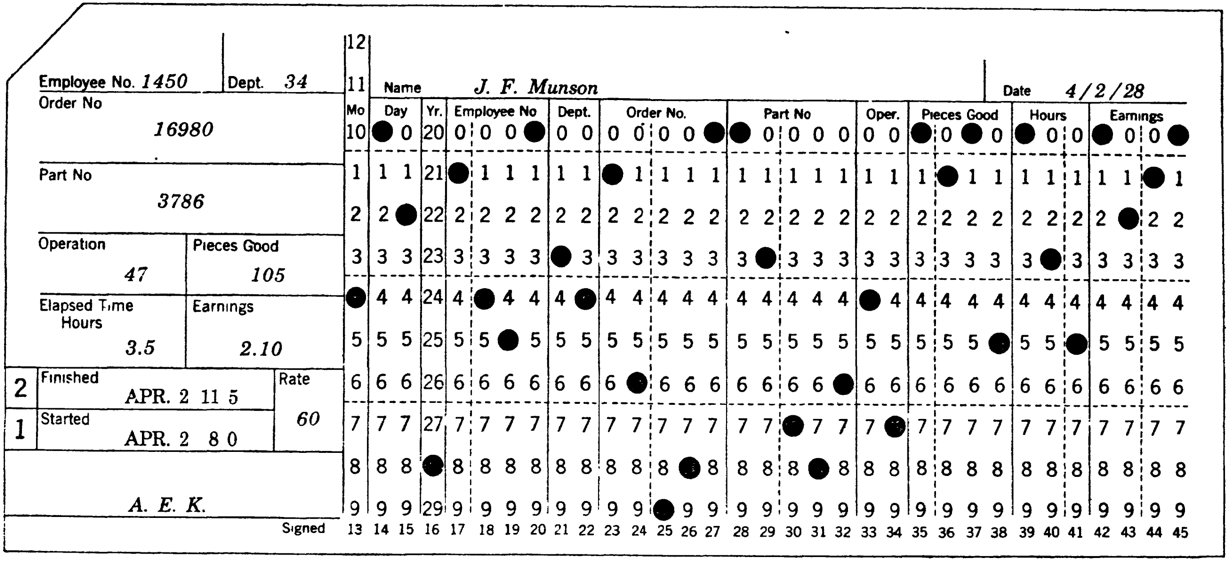
DAILY COST CARD

No. 88 DATE Jan 11, 1929

NAME Edward Brennan

Clock Time Record	Time		JOB No.
1929 JAN 11 9 10	1.10	OFF	3876
1929 JAN 11 8 00		ON	
1929 JAN 11 9 30	.20	OFF	3877
1929 JAN 11 9 10		ON	
1929 JAN 11 10 45	1.15	OFF	3880
1929 JAN 11 9 30		ON	
1929 JAN 11 12 00	1.15	OFF	3894
1929 JAN 11 10 45		ON	
1929 JAN 11 3 00	2.00	OFF	3897
1929 JAN 11 1 00		ON	
1929 JAN 11 5 00	2.00	OFF	3908
1929 JAN 11 3 00		ON	
		OFF	
		ON	
		OFF	
		ON	

Form 86: Time card—whole day for one man.



Employee No. *1450* Dept. *34*

Order No *16980*

Part No *3786*

Operation *47*

Pieces Good *105*

Elapsed Time Hours *3.5*

Earnings *2.10*

2 Finished APR. 2 11 5

1 Started APR. 2 8 0

Rate *60*

A. E. K.

Signed

Name *J. F. Munson*

Date *4/2/28*

Mo	Day		Yr.	Employee No				Dept.		Order No.					Part No					Oper.		Pieces Good				Hours			Earnings			
12																																
11																																
10	●	0	20	0	0	0	●	0	0	0	0	0	0	●	●	0	0	0	0	0	0	●	0	●	0	●	0	0	●	0	0	●
1	1	1	21	●	1	1	1	1	1	●	1	1	1	1	1	1	1	1	1	1	1	1	●	1	1	1	1	1	1	1	●	1
2	2	●	22	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	●	2	2
3	3	3	23	3	3	3	3	●	3	3	3	3	3	3	3	●	3	3	3	3	3	3	3	3	3	3	●	3	3	3	3	3
●	4	4	24	4	●	4	4	4	●	4	4	4	4	4	4	4	4	4	4	●	4	4	4	4	4	4	4	4	4	4	4	4
5	5	5	25	5	5	●	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	●	5	5	●	5	5	5	5
6	6	6	26	6	6	6	6	6	6	6	●	6	6	6	6	6	6	6	●	6	6	6	6	6	6	6	6	6	6	6	6	6
7	7	7	27	7	7	7	7	7	7	7	7	7	7	7	7	7	●	7	7	7	●	7	7	7	7	7	7	7	7	7	7	7
8	8	8	●	8	8	8	8	8	8	8	8	8	●	8	8	8	8	●	8	8	8	8	8	8	8	8	8	8	8	8	8	8
9	9	9	29	9	9	9	9	9	9	9	9	●	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45

Form 87· Tabulating card—punched for labor record.

When cards have been punched for all items to be recorded or distributed, they are run through a sorting machine, which can be set to sort the cards on any desired basis. Cards similar to Form 87, for example, could be sorted by order number, by employee number (to get the payroll), by machine number, or by operation number. After each sorting, the cards in any one class can be run through a machine which will add them together and give the total amount on all cards for a given order number of a given employee. Ordinarily the machine simply accumulates the total and shows it on the register, but there are other types of machines which will make a written record of the data on the cards, which can be used as journals or voucher registers.

Summarizing by Tabulating Equipment

Equipment of this sort has a great many applications in cost accounting work. Form 87 is an example of its use in connection with labor records; wherever job tickets are issued or individual jobs done by individual employees or by groups of employees, the numerous items thus produced can be handled very effectively by tabulating equipment. A sorting of the cards by employee number will give the payroll, and the second sorting by order or job number will give the charges to production in detail. Corresponding records may be made for materials purchased and for materials requisitioned from the stores; the cards may be punched to show the kind of material by account number, and the order to be charged; by sorting and accumulating them, therefore, it is possible to get the total amounts of credits to different material accounts, and corresponding debits to order numbers, for materials taken out of stores during the period. Physical inventories may be tabulated in the same way if cards are punched for the different quantities of the various items found in stock and for the general classes to which they belong. The machines will not only accumulate the amounts of material issues or labor tickets on the machine indicator but also will make a printed list of the items, which may be used as part of the permanent record.

One of the most common uses is in the original recording and distribution of vouchers, thus supplying a voucher register. All the leading facts can be punched on the cards, which may then be run through a recording machine in order of date at the rate of 40 or 50 per minute; if the cards are then sorted according to the account numbers to be charged, a second record may easily be prepared which will give the total charges to each account. Freight records, with distributions to products or to districts, are entered and similarly used. Statistics of sales by district, by product, by customer, or on any other basis may be obtained by punching cards to correspond with the sales invoices.

Accounting by Tabulating Equipment

A further distinct step occurs when, in addition to simply adding items, subtractions are also made on the equipment, and balances brought down. This makes the equipment applicable to a great variety of operations used in accounting and costs. Material inventory records, with additions for purchases, subtractions for material issues, and balances brought down to represent current inventories, are easily handled in this way. When payroll records are made, as described above, deductions of various kinds are also possible. Ordinary debit and credit accounting is done by this method, including the simultaneous provision of control accounts, with the more detailed records of the subsidiary accounts. Thus it becomes possible to run a subsidiary cost ledger, containing numerous manufacturing expense and work in process accounts, with a general ledger control for it.

Further combinations are made possible by the use of multiplying equipment which enables the operator, for example, to multiply hours by rates on labor cards, or quantities by prices on stores cards, and to have the machine automatically punch the resulting amounts. Other machine computations are also possible, such as deductions from payroll for insurance or savings accounts. For record and report purposes, the use of punchings which will reproduce alphabetic printing as well as figures is of value. Then again, it is possible to addressograph names on a payroll and then run the amounts and deductions through a machine controlled by punched cards. Form 88 illustrates a payroll record so prepared.

Adaptability of Tabulating Equipment

The question of when to use tabulating machines is a complicated one. Their use is growing rapidly, and there are many

PAY ROLL

PERIOD ENDING

NAME	CLOCK NO.	CLOCK NO.	HOURS	GROSS PAY	DEDUCTIONS				NET PAY
					INSURANCE	SAVINGS	TOOLS	MISC.	
Haslett, T.	301	301	402	2340	25	100		50	2165
Warwick, H. T.	302	302	462	2486			100	120	2266
Reeves, P.	303	303	450	2025	25			25	1975
Sanderson, E.	304	304	445	3115	25				3090
Smith, M.	305	305	375	2450			200	25	2225
Jackson, H.	306	306	356	2308		100			2208
Jones, F.	307	307	450	3100				575	2525
Harrison, L.	308	308	420	2802	25		150		2627
Adams, F.	309	309	400	2232	25				2207
Johnson, H.	310	310	269	1883					1883
Larkin, A.	311	311							

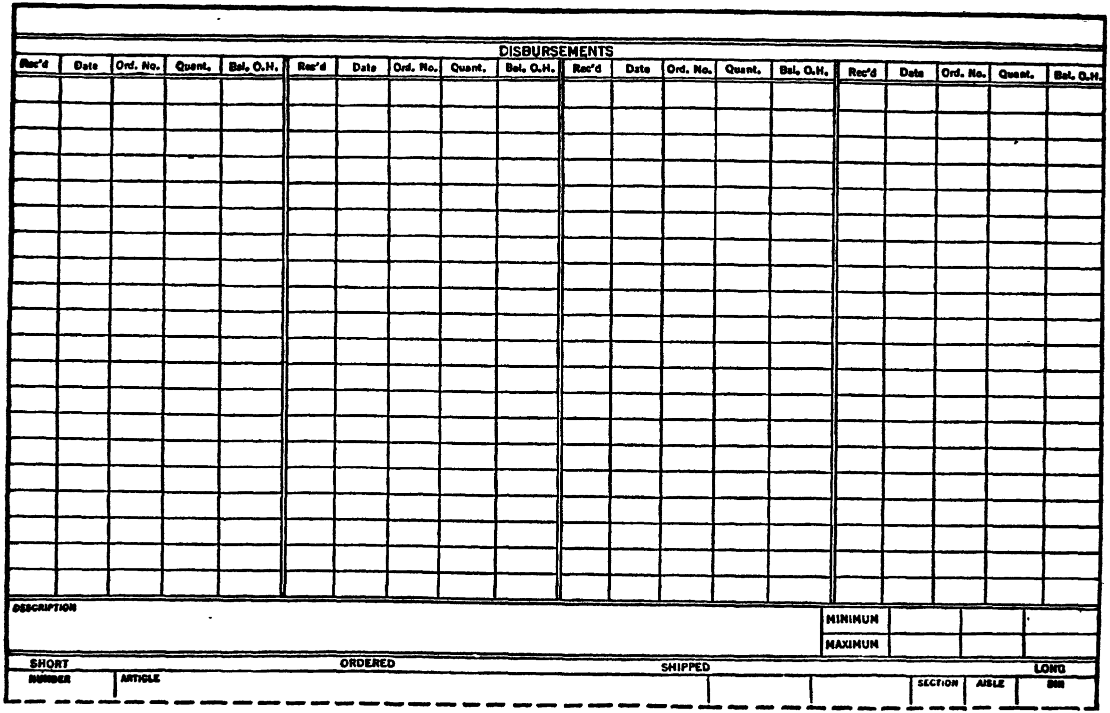
Form 88: Record prepared from punched cards.

concerns in which their advantages are apparent. There are, on the other hand, numbers of other companies which have made careful studies and have concluded that the savings would not be sufficient to justify the additional expenditure involved. Some firms, for example, have figured that unless they could save the time of two, and perhaps three, clerks, the equipment would not pay for itself. To make the investment economical it is necessary to have the combination of a large number of items with a number of different classifications or tabulations to be made from them. There is also to be considered the fact that much of the company's stationery will have to be redesigned and adapted to the tabulating machines.

There is, however, another aspect to be considered in addition to saving expense on the present operations. Sometimes the tabulating machines will give additional information which would not be possible without them. In such cases the investment may well be worth while even without any demonstrable saving of present expense. It is, on the other hand, necessary to guard against any disposition to devise new classifications and tabulations merely for the purpose of keeping the tabulating equipment occupied. A careful consideration of all these factors will disclose many occasions when the tabulating machinery will be obviously advantageous; but there are others where the volume of work will not justify their adoption. To meet these cases, however, it is possible that some form of professional service organization may be developed, in which the records of a small business may be tabulated, and the results returned to the company for a small fee, thus saving the company the trouble and expense of a complete installation.

Visible Record Equipment

Another type of equipment which is extensively used is that known as visible records, in which, while the greater part of the record may be concealed, an index or key or guide is visible along one or more edges of the record, as shown in Form 89. The care with which such records must necessarily be handled and the facility of finding any desired information are the obvious advantages of these records. They are suitable for inventory records, with the part or piece name and number visible; for job cost records, with the name and number of each job visible; for employee records, with the name of each



DISBURSEMENTS																			
Rec'd	Date	Ord. No.	Quant.	Bal. O.H.	Rec'd	Date	Ord. No.	Quant.	Bal. O.H.	Rec'd	Date	Ord. No.	Quant.	Bal. O.H.	Rec'd	Date	Ord. No.	Quant.	Bal. O.H.

DESCRIPTION

MINIMUM

MAXIMUM

SHORT NUMBER | ARTICLE | ORDERED | SHIPPED | LONG SECTION | AISLE | BIN

Form 89: Inventory record for visible filing.

employee visible; for standard bills of material, with the name of each assembly visible; or for any other type of record to which frequent reference needs to be made.

RECORDERS 4

SALES	
TERRITORY	1
SALESMAN	Hutton
DATE	7-15

COST		INDUSTRY	SALES	
		A-CANNING		
12	75	1 Meat	17	00
10	50	2 Vegetable	14	00
		B-CHEMICAL		
13	00	1 Ceramics	17	34
20	25	2. Chemicals	27	17
11	45	3 Fertilizer	15	27
17	80	4 Film and Rayon	23	71
23	35	5 Leather	31	13
14	00	6. Paint and Varnish	18	67
15	00	7. Soap	20	00
		M-RUBBER		
34	00	1. Boots and Shoes	45	34
15	25	2 Mechanical G.	20	34
24	80	3 Tires and Tubes	33	04
		N-TEXTILE		
18	92	1. Cotton	25	23
24	35	2. Rayon	32	47
19	48	3. Silk	25	97
27	50	4 Wool	36	67
		5 Finishing		
14	73	6 Knitting	19	64
16	87	7 Laundries	22	50
		O-MISC'L		
723	67	TOTAL	964	81

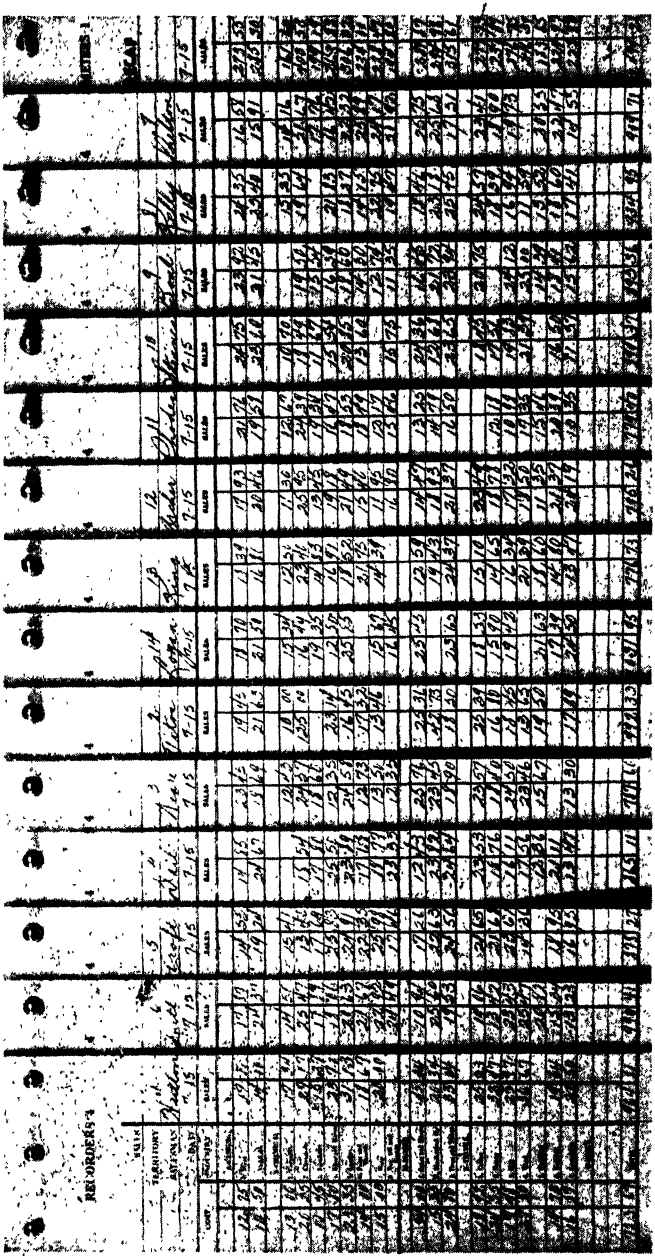
Form 90: Record of sales, punched for peg board.

Peg-board Records

An arrangement which has recently had rapid growth is the peg board, on which records are arranged in series for adding. Thus, Form 90 is a single list of the sales of one salesman, showing the sales value and the cost value by items. Form 91 shows the same form, with many similar forms, placed on a peg board and added crosswise, the totals being shown at the right, under Recap. By transposing the sheets the Cost columns could be made visible and also added crosswise. Many forms which must be summarized can, by a simple punching at the top, be adapted to this peg-board arrangement and so added easily by adding machine. The advantage is that it saves recopying of original forms on summarizing records.

QUESTIONS AND PROBLEMS

1. If you were called upon to investigate an accounting office, and to report upon the advantages or otherwise of adopting mechanical equipment for doing accounting work, how would you go about the study, and what would be the topic headings of your report and recommendations?



Form 91: A peg board arranged for adding.

2. The Park Manufacturing Company used a special metal alloy as its principal raw material. The following facts cover the year 1932:

Inventories on hand as of January 1, 1932, were as follows:

Raw Material: 300,000 lb. at 8¢		$24,000	
Work in Process: 900,000 lb. at 11¢		$99,000	
Consisting of: Raw Material	$65,250		
Labor	20,250		
Burden	13,500		
Total	$99,000		
Finished Goods: 200,000 lb. at 15¢		$30,000	
Raw material purchased during 1932:			
9,550,000 lb. at an average cost of 7¢ per pound			$668,500

A summary of the monthly cost sheets gives the following information:

a. 9,050,000 lb. of raw material entered production. Priced on the first-in first-out method the total cost was $636,500.

b. Total payroll for the year plus wages accrued at the close of 1932 amounted to $409,500.

c. Variable overhead amounted to $143,500 (actual).

d. Fixed overhead amounted to $210,000 (at standard). (See discussion of fixed burden below.)

e. Number of pounds finished 8,830,000.

f. Scrap recovered was 310,000 lb. at a standard allowance of 4¢ per pound, $12,400.

A summary of actual fixed overhead according to the financial books of account amounted to $215,000.

Compared with a normal year production during 1932 was off 40 per cent. The executives accordingly instructed the chief accountant to charge 40 per cent of the fixed overhead to a special unabsorbed burden account so that it would not appear in either the cost of goods manufactured or the cost of goods sold.

Raw material on hand at the close of the year, according to the inventory cards, all cost 7¢ per pound. These inventory cards were kept separate from the financial records, which showed only the beginning inventory and purchases until adjusting and closing entries were made at the end of the year. The current market price on the raw material was 5¢ per pound on December 31, 1932.

Some of the customers of the company evidently looked forward to a rise in business during the spring of 1933 and had placed firm contracts as follows for delivery by April 1:

Contract number	Pounds	Sales price per pound
1568	200,000	17 5¢
1569	800,000	18
1570	250,000	16

A physical inventory showed the following quantities on hand at December 31, 1932:

Raw Material, pounds	799,900
Work in Process (considered one-half finished), pounds	809,500
Finished Goods, pounds	330,000

a. What was the cost of finished goods manufactured during that year? (For per pound costs, two decimal places of a cent will suffice.)

b. Show the cost of goods sold, at standard and at actual. (Indicate clearly your method of evaluating inventories.)

c. What would be the advantages of installing a standard cost system in this company? Do you see any objections? What would be the main steps in doing this?

d. Arrange all this information as it would appear in the cost of goods sold section of the company's income statement for 1932.

3. What would you believe to be the general limiting factors in the use of machines in cost accounting?

4. In what respects would the consideration of the purchase of a machine for the office differ from the purchase of a machine for productive work in the factory?

XXIII

THE BUDGET IN BUSINESS

The Business Plan

Within recent years the attempt has been made to apply a budgetary procedure, similar to that which has long been used in governmental accounting, to all phases of business management. The essence of a budget is a detailed plan of operations for some specified future period, followed by a system of records which will serve as a check upon the plan and will indicate the extent to which it has been fulfilled. The budget is not only a financial program; it should be drawn also in terms of quantities and of operations; it will then serve as a complete program of activities of the business for the period covered. Every business must do a certain amount of planning and looking forward, but this part of the work is apt to be irregular and ineffectual unless some orderly routine is adopted whereby all aspects of the business will receive due consideration.

As with other procedure for business control, it is possible to overemphasize the mechanics which are employed in budgeting. Many examples might be given of firms which have undertaken an elaborate system of forms, records, and reports, only to find that a great deal of work was being done with no particular end in view, and that the real elements of business control and planning were still not being attained. For purposes of budgeting it is necessary to determine very clearly what the principal matters are which concern the welfare and progress of the particular business under consideration, and to provide for adequate attention to be given to those matters. It is further necessary that the budget should be regarded not as a stationary affair but as one of the instruments for business progress; this will mean continual revision not only of its details but of its principal features also in the light of accumulated experience.

General Budgetary Procedure

Before dealing with the manufacturing budget, it is necessary to consider the general budget for the entire business, since the manufacturing budget is a part of it.

One of the first essentials for successful budgeting is that some person or committee shall be designated to carry on the budgetary work, and it is necessary that those who are responsible for this work shall have the requisite authority to carry it out. This means not only that they must be in a position to call upon the departmental heads to supply the estimates and reports which are necessary for the compilation of the budget; they must be able to enlist the active support and interest of all those who in any way contribute to the making or to the execution of the budget.

Too much stress cannot be placed upon the importance of having senior executives contribute to the preparation of the budget. In a number of cases this work has been left to the clerical staff, and all that they could do was to make something up from the records of past periods, with a few changes based upon the irresponsible guesses of men who did not know what the real plans of the executives were. It should be clear from the outset that such activities can have no beneficial effect upon the conduct of the business. If, on the other hand, the senior executives make it clear throughout the organization that the budget is to be regarded as one of the main instruments of management, and that the budgetary reports will be interpreted as a measure of the success of each manager, then there will be no question about active support being accorded to the budget.

Thus the budget becomes what General Dawes described, at the time of the introduction of the federal government budget, as a regular instrument for the exertion of executive policy and pressure. That is to say, it is not sufficient for the senior executives merely to outline their general plan; they must see that these plans are communicated in detail to responsible subordinates right down the line, and that all activities harmonize with these plans.

Sources of Budget Information

The sources from which the estimates are drawn for the compilation of the budget will vary with different businesses, according to their organization. There will be similar variations in the order of procedure, as to the personnel which prepares the first estimates and does the subsequent revising. The accounting department will contribute largely from its records, and it is likely that these records themselves will be modified considerably with a view to furnishing information which the budget from time to time shows to be necessary. In cases where careful analysis of general business and economic conditions is necessary, a department of statistical experts will probably be set up for this purpose. In all cases the general opinions and detailed estimates of department heads will be obtained, partly with a view to utilizing their knowledge and experience and partly with a view to being able to hold them responsible for the standards of accomplishment which the budget sets up. In cases where the business involves considerable engineering aspects, the engineers in charge frequently contribute largely to the budget, since it is they who will principally control its execution.

Past or Future Figures

One important matter will be the extent to which the budgeted figures are based upon the past or are real and direct estimates of the future. As has been shown, this will largely depend upon the character and standing of the staff in whose hands the budgetary work is placed. The higher up and more responsible are the men who prepare the budget, the more likely it is to be a genuine plan of future operations. Only the senior executives can know well in advance how much sales stimulation is going to be applied in the form of advertising or sales promotion work; in the absence of information on these matters no reliable estimates can be prepared as to the probable volume of sales or the costs of making them. In this connection it is interesting to note that in actual practice the budget is usually in charge of the treasurer or comptroller, with the president or general manager taking an active interest in it.

In one large industrial concern, upon the first introduction of the budget, the figures consisted practically of a summation and digest of the actual figures for the preceding four years; it was assumed that these would be projected into the future along the same trend lines as had already been developed. As the years progressed, however, and the budgetary committee gained more and more experience, they relied less upon the figures of the past and based their estimates for the coming period more directly upon the actual plans for that period, until it reached a point where very little attention was paid to the past figures. In other words, the stage was reached in which the budget was a genuine management plan for the future, from which the figures of income and expense were directly estimated.

In some cases a company adopts one or two basic principles which will greatly influence its annual budgets, setting fixed points about which the budget tends to be created. One prominent industrial concern, for example, expects its sales to grow on the average by 10 per cent per annum. Naturally it does not anticipate this growth in a perfectly regular manner every year; the experience of 1929–1932 would in any case knock that out of them; but having surveyed its markets all over the world, and the conditions which influence its sales, it figures that it will, for a considerable number of years to come, probably realize an average increase of 10 per cent. If the company falls behind that amount of growth in any year, all the more pressure is placed upon the organization to make it up the following year. A theory like this will naturally be strongly in mind at the time when the budget is being prepared, and there will be a constant tendency to make the budget reflect this general average rate of growth. Here again care must be taken not to permit such a notion to become too arbitrary or to prevent the business from adapting itself easily to changing conditions.

Period of the Budget

In practice a good deal of variation is found in regard to the length of time to be covered by any one set of budget estimates. Since one year is the common period for financial accounting, it has naturally been adopted as the most usual period for budget estimates. Even within this period of a year, however, practice differs greatly concerning the degree of completeness and detail with which the budget figures are prepared for the various months; sometimes only the first three months are prepared in detail, sometimes six months, and sometimes the whole twelve months. When only part of the year is prepared in detail, the balance of the period is shown in general outline by means of aggregate totals; each month an old month is dropped from the detailed budget and a new month added, keeping the required period of three to six months in advance. But, as mentioned later, in connection with engineering budgets, one year is often regarded as too short a time for planning purposes, and that for several reasons. Plans which involve substantial extensions of the plant, with investments of large sums in fixed assets, must necessarily depend upon our estimate of the course of business for a considerable period of time to come, and it is necessary to answer several questions relating to the future: first, whether the total volume of business during a reasonable period of years will justify the new plant extensions; second, what lines or types of product will go to make up this total, thus deciding what types of equipment will be required to make them; third, what is likely to be the rate of progress of the arts of manufacture in that industry, and what kind of changes are likely to occur; fourth, what is going to be the active policy of the management for the stimulation of sales, by price changes and other methods; and, fifth, whether this is the right point in the movement of prices at which it is wise to spend large sums of money on capital improvements. All of these are matters which will not work themselves out within the space of one year; nor will the profit and loss results of one year afford sufficient basis for the contemplated investments in plant. For these reasons attempts have been made, with varying success, to prepare budgets for periods all the way from 1 to 10 years.

The Natural Budget Period

No general rule can be laid down on this question of the length of the budget period. The circumstances of each industry and of each company will tend to indicate what is the appropriate and natural budget period for that industry, by consideration of two main questions. The first question is: What degree of general stability obtains in that industry or, in other words, how rapid and far-reaching are substantial changes in the industry? The answer to this question will determine the length of time for which the management can see into the future with reasonable certainty. The second question is: How long a time is required for the results to be realized from major changes of policy put into effect by the management?

Some interesting contrasts in regard to both these questions may be seen by studying the common situation of a public utility company as compared with the more openly competitive manufacturing industries. The answers to both questions asked above will suggest budgeting further into the future for a utility company than for the ordinary manufacturer. Because the utility company under regulation has a greater degree of control over its markets, its management can plan and determine the future course of events with much more assurance of being able to carry out the plans than is possible with a manufacturer who, exposed to violent competition, cannot tell what his competitors will do next. In regard to the second question, moreover, the price schedule of a manufacturer is usually designed to serve for one year or a season of even less duration; its results will be completely realized within that short period. Thus an automobile manufacturer's prices are set for one year and may be changed in even less time if the models are changed or other circumstances require it. Within that short period the price schedule will definitely yield satisfactory results or will fail to do so. The position of a public utility, a gas company, an electric light and power company, or a telephone company is different in this respect. A set of rates or prices for different types of service is likely to stand for a number of years, and a number of years will be required to show whether the results, in the shape of a satisfactory growth in business with different types of customers, have proved the rate schedule to be a good one or a bad one. Circumstances like this have created a general tendency for public utility companies to budget or plan for longer periods than manufacturing companies.

During the year 1931 the Bell Telephone System of companies spent a total of $400,000,000 on construction and replacements, the net additions to plant accounts being about $150,000,000.[1] Such tremendous investments in long-time capital assets call for the most careful long-time planning. This work is a matter distinct and separate from the annual budget of current operations and is more in the nature of forecasting as discussed below. For this purpose the study covers the three succeeding years, one year in complete detail, and two years in more general form, the whole plan being revised every four months. For the larger plant constructions these studies are projected for 10 years, or even longer, into the future.

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[1] *Bell Telephone Quarterly*, July 1932, p. 265.

Different Periods for Different Purposes

But it is not necessary for any one company to use the same period for all purposes. Almost any company which does any budgeting will prepare a sales budget on a value basis for a period running up to a year. Inventories and production would be planned and budgeted in relation to the business season of that industry and to the general movement of the business cycle. Plant extensions, borrowing, and large investments in fixed capital will, as already stated, in any industry involve some survey of a sufficient length of time for the recovery of this investment through sales. The cash budget will be the most continuous and closely watched of all the sectional budgets. Thus the differences in budget periods arise not only from differences in the nature of the business in different companies but also from the different operations within the same company.

Relation of Budgeting to Forecasting

Budgeting and forecasting are sometimes spoken of in the same breath as if they were identical, but in the interests of clear thinking it is desirable that a distinction be maintained between them. Forecasting means an estimate of the future trend of general business or of the business of a given industry, based upon an analysis of all available data. Budgeting has been defined as the operating and financial plans of a specific company. Naturally the budget of a company will be very greatly influenced by the forecasts of future business for the industry in which the company is active, especially in the matter of determining the sales volumes which shall be incorporated in the company's budget. But even for this item the forecast is not the only criterion of the amount of sales volume which should be budgeted for the company; there is also to be estimated the percentage which the company will take of the total volume of business indicated in the forecast as being available for the industry. A company's percentage of the total business may increase or decrease during the budgetary period, depending upon the success or otherwise of the management policies and those of competitors and the type of effort which they think it well to make at this time.

Basis of Forecasting

The steps by which a forecast may be made, which will be reliable and helpful in budgeting, will vary greatly according to the nature of the business; an enormous volume of published information and statistics on business conditions is available, but much of it will not be pertinent in any given case. A great deal of skill is therefore required in selecting that material which has a bearing on the business in question. These data will fall into three general classes: (1) the internal facts and figures of the company itself, (2) the facts and figures relating to the whole industry of which the company is a part, (3) facts and figures relating to general business conditions; it is, of course, in the last group that the greatest need for selection is required if the collection of useless material is to be avoided. It is necessary to find information about industries which bear some relation to our industry or which for some reason have the same economic behavior. For example, a manufacturer of plumbing supplies or bathroom fixtures or fire sprinklers will be interested in the general volume of building construction; but each will want to go further and to ascertain the volume of those particular types of building construction which utilize his products. As to economic behavior, some industries go through very violent swings of supply and demand; in periods of business activity their sales may be five, six, or even twenty times as great as in dull periods. Such industries include the heavy iron and steel trades, machinery and machine tools, shipbuilding, and other industries making production goods. The industries producing goods for regular consumption, on the other hand, show a much more steady aggregate output. The total volume of clothing and shoes produced and sold in any one year will in the widest swings scarcely approach a figure double that of the previous year, while in the case of food the yearly variation will be a relatively small percentage. Within any one of these groups there may in times of depression be some shifting from high-priced lines to lower priced lines, a movement which forecasting should take into account, but the general total quantity will vary very little. The forecasting work of any company will, therefore, endeavor at the outset to place it in one of these economic groups.

When all the data which bear the closest relationships to our particular company have been gathered, it next becomes necessary to arrange them in order of their time sequence; that is to say, it is necessary to discover which particular events regularly fall in the early stages of business movements, and which events regularly follow. If we can with some assurance find the place of our company in this sequence of events, we can observe which events or conditions usually precede the movements in our business, a discovery which will help to make our forecasting machinery more specific.

Reference has been constantly made to the use of statistical data in forecasting. It cannot be too strongly emphasized that forecasting has two aspects: first, the expression or measurement of quantities in figures; and, second, the reasonable interpretation of these quantities. The latter requires a philosophical and intelligent mind, well grounded in economics and accustomed to survey the course of events with some understanding of cause and effect. The absence of this faculty has often rendered worse than useless a great deal of work based only upon charts, figures, and other statistical material. In other words, good sense in judging the meaning of the facts gathered is even more important than the accurate collection of the facts.

Divisions or Types of Budget

Many companies budget one or more departments or activities, without necessarily budgeting all of them, as is shown very clearly from the following table:

NUMBER OF COMPANIES USING EACH OF THE NINE PRINCIPAL KINDS OF BUDGETS, AS REPORTED BY 162 COMPANIES[1]

Kind of Budget	Number of Companies
Sales	141
Production	128
Manufacturing expense	114
Marketing expense	120
Administrative expense	114
Capital outlay	84
Cash	66
Profit and loss	78
Balance sheet	37
All nine kinds listed	37

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[1] From *Budgetary Control in Manufacturing Industries*, p. 18; published by National Industrial Conference Board.

The interesting fact about this table is that, of the 162 companies surveyed, only 37 companies used all nine kinds of budgets referred to. It is very natural that sales should be the first thing to be budgeted, since these determine all other activities of the business. It is natural that production should follow next in order, since one of the main objects of budgeting is to coordinate production with sales; in this way greater evenness in factory operations can be attained, with lower costs, less labor turnover, and reduced inventories. It is natural also that expenses should be the next thing to be budgeted, as these are the outlays which need to be carefully watched. A rather surprising feature in the table is the relatively smaller number of cash budgets; two very different interpretations of this situation might be made. First, the companies surveyed might be in such a comfortable cash position that they did not need to worry greatly about their cash balance; some support for this view could be found in the statement that the companies listed were the leaders in their respective industries. A second possibility, however, is that, incorporated in the sales or production or expense budgets which these companies operate, there might very well be a section showing the effects of operations on the cash balance. In that event it would not be strictly true that these companies did not have a cash budget, although they did not necessarily have a separately prepared cash budget.

The Sales Budget

In almost every case the first part of the budgetary procedure will be to determine the amount of business which the company desires or expects to do during the coming budgetary period. Two principal agencies who participate in the setting up of the sales budget are (1) salesmen who actually do the selling, and (2) the sales managers who plan and execute the general marketing policies of the business. The ideas of salesmen on the subject of future business are valuable but can seldom be taken too literally because of their well-known temperamental qualities. Their bias, therefore, must be determined as accurately as possible, and corrected by the sales managers, who are supposed to be business executives with level heads and shrewd judgment. They, in turn, will be aided by the reports of past experience furnished by the accounting department and by the analyses of general business and economic conditions made by the statisticians of the firm. With all this material the sales department will prepare an estimate of the amount of business it expects to do during the coming period, and this estimate will, when necessary, be subdivided into territorial groups, into commodities, and into periods of time, such as weeks or months.

Incorporated in this sales budget should be an estimate of the selling expenses which the sales department will incur in making the sales set forth in the sales estimate.

The Sales Budget Should Be Real Figures

There is a tendency in some places to think that it is necessary to prepare two sets of figures in connection with the sales budget; in fact this seems actually to be done in some cases. It is argued that the estimated sales should be placed at high figures in order to supply a proper stimulus for the sales department, an incentive for them, a high mark for them to shoot at. But it is recognized that, for purposes of making the actual plans of the company for manufacturing programs and for computing the financial requirements, it is necessary to make these estimates of sales as nearly accurate as they can be made. With these thoughts in mind, some business men have prepared double budget figures, to represent the two points of view.

This, however, is not good business. It is obvious that the higher figures are something more than the management actually believes will materialize; the sales department is being asked to do more than anybody believes they can do. This is a form of poker playing which is not likely to deceive anybody for long or to have permanently good results. If the sales department is not considered sufficiently ambitious, steps can be taken to remedy that condition by applying to them the right sort of push, or by changing the personnel if necessary; but when a right attitude and spirit on their part have been developed, no advantage is to be gained by using pressure in the shape of fictitious figures. It is in every way desirable that an air of reality and sincerity should prevail in the preparation and execution of the budgets; the figures should represent everybody's best estimate as to what the actual facts and conditions are going to be. This will provide a much surer basis for making plans, and the staffs of all departments will be much more interested and in earnest about carrying out these plans.

Revision of the Sales Budget

The sales budget will be submitted to the inspection of the general management who will consider whether in their judgment the estimates are reasonable; they also will probably be assisted in their task by accounting and statistical reports prepared for them. It is an important matter that this part of the work shall be carried out with the greatest possible care, because when the general managers have set their seal of approval upon this budget they have not only defined their objectives but have also to a certain extent limited their ambitions. The judgment and activity of every one of their subordinates are likely to be considerably affected by the standard of accomplishment which the management is thus setting up for him. Among other things the general management will take into account the views of the manufacturing departments, both as to the possibility and as to the advisability of producing the goods called for in the sales budget. At this point, therefore, the production departments begin to participate in the budgetary activities.

The Manufacturing Budget

The factory officials will receive a copy of the proposed sales budget and from it will observe in particular the quantities of the different products of the company which the sales department expects to sell. These finished products will be broken down in the factory into terms of raw materials required and manufacturing processes to be performed upon them. Manufacturing processes in turn will be analyzed into hand labor operations and machine operations or processes. In order to judge whether the factory is in a position to deliver the goods called for, it is necessary that they shall previously have prepared a complete statement of the production capacities of the various departments of their factory. It will then be possible to match the goods called for by the sales budget, or rather the manufacturing processes involved in producing these goods, against the productive capacity of the various departments, machines, and men at the disposal of the factory management.

This will show whether the proposed sales program utilizes the productive capacities of the plant well or badly. If the factory managers find that they can turn out the products called for with their present equipment of men and machines, they will probably approve the sales budget without change. If, on the other hand, the sales budget involves additional machines or the employment of additional labor, the factory management must make a statement on that subject, with recommendations as to the advisability of the extensions. If the general management ultimately decides to carry out the sales budget, their instructions to that effect must include authorizations to the production department for the expenditures necessary for the extensions prescribed. In case sales budget would leave any part of the production facilities idle for any considerable period, the factory managers should call attention to this fact, with a view to seeing if their equipment cannot be utilized better.

The Cost Department's Contribution

When the quantities of the various products to be manufactured have been determined, the manufacturing department must compile estimates of the cost of manufacture, and at this point the work of the cost accounting department will come in. It is necessary that reliable records should have been kept on the labor and burden costs of all operations involved in the manufacture of the products scheduled; by applying these unit costs to the quantities, the total amount of money involved by the manufacturing program for labor and manufacturing burden will be ascertained. These figures should not, of course, be determined entirely from the records of the past; full consideration must also be given to possible changes in wage rates or in regular expense items and to new expenses which will be involved in any plans for extension of operations.

In connection with the budgeting of operating expenses, it is helpful to have items of expense classified as fixed or variable charges, the former being practically uniform for any output, as long as the present organization and equipment continue, and the latter more or less variable in proportion to the output. If new items of plant are added, or changes in the organization take place, even the so-called fixed charges will have to be adjusted accordingly. But it facilitates the making of future estimates if statements for past periods are regularly prepared with items classified in this way.

Material Costs

The estimates of cost for the finished products will not be complete until the costs of materials have been compiled. This work will probably be done by the purchasing department, which presumably is conversant not only with past and present prices but also with price trends. From the quantities of goods scheduled for production in the general manufacturing budget, schedules will be prepared showing the quantities of the various classes of materials and supplies which will be required. To these quantities the purchasing department must apply such unit prices as in their judgment they will have to pay during the coming budget period. In any large plant where a statistical force is available, it is likely that they will contribute to this part of the work also, to the extent of assisting in the forecast of future prices.

It is sometimes argued that fluctuating material prices make a budget impossible or valueless. On the contrary, however, the budget may by necessitating a study of these fluctuations enable a more intelligent purchasing program to be devised. In any case, better results are likely to be obtained by giving forethought to the subject than by a haphazard policy, and the budget provides for such forethought.

Maintenance and Repairs

Certain amounts will be included in the statement of manufacturing costs to cover the costs of repairs and maintenance which are expected to be carried out during the budget period. In large plants, where the units of plant are of great value and considerable variety, it is often desirable to make a general program covering three years, or even five years, for the repairs and maintenance of the plant and equipment. By this means it is not only possible to equalize expenditures over the different years; it is likely that much more systematic handling of the plant will result, and that better service will be derived from it. In the absence of a long-time plan, the care of the plant sometimes becomes haphazard; machines are given attention after they have broken down, thus involving expensive delays and perhaps more expensive repairs than would have been necessary if systematic care had been regularly given to the plant.

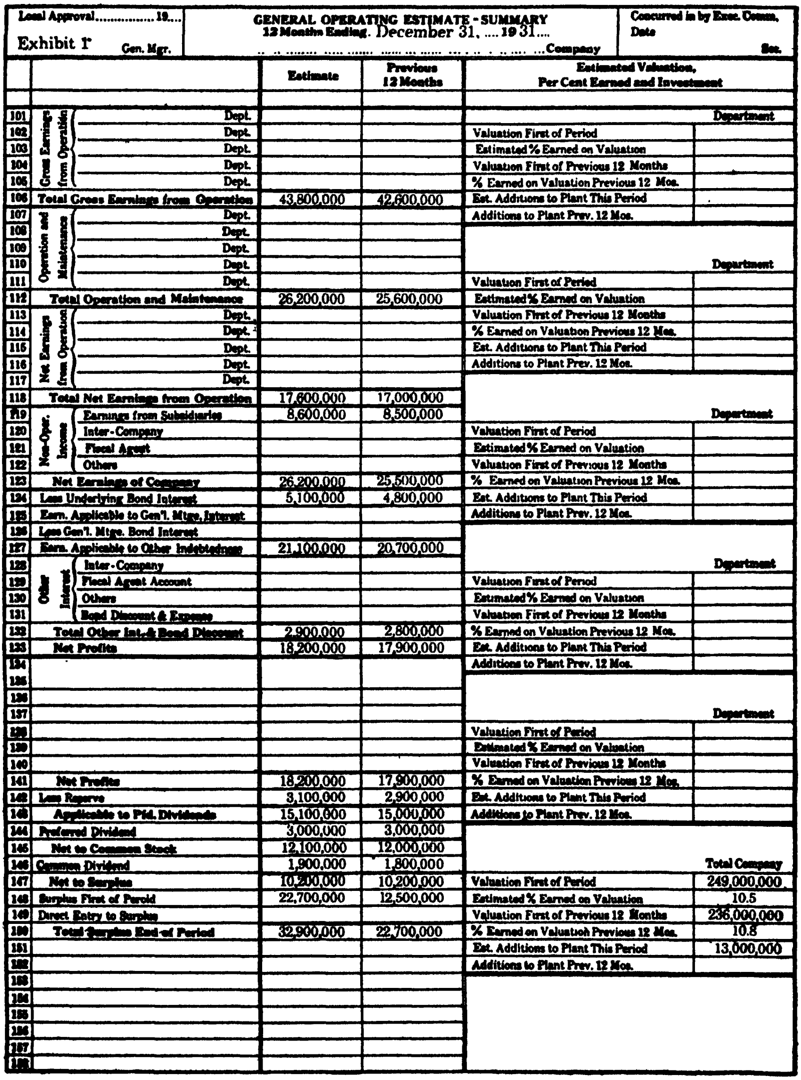
The Financial Budget

The sales budget, with its statement of estimated sales by periods, will indicate the sources and amounts of the expected revenues of the business and will also include a statement of the expected selling expenses which will be incurred in doing that amount of business. The manufacturing budget, as has been seen, will include schedules of the material and manufacturing costs of producing the goods. To these must be added the estimated general disbursements of the corporation, such as for officers' salaries, general office expenses, bond interest, and the like. These items can be supplied by the treasurer, after which the data will be complete for the compilation of a general budget of receipts and expenditures. Since the main purpose of this part of the budget is to balance the cash receipts for each period against the cash disbursements, it is very necessary that the various estimates involving cash movements shall be broken down into periods. With regard to the income from sales, for example, it is obvious that the average length of credit and the amounts of accounts receivable which will probably be outstanding at the end of the various months must be taken into account. In the purchasing of materials and other manufacturing disbursements, the stocks of raw materials and finished goods to be held from month to month must similarly be considered. When this has been done, it will be possible to determine whether the normal revenues of the business, derived from sales, will continuously provide sufficient cash to finance operations or whether it will be necessary during certain periods of the year to resort to borrowing. If this is necessary, plans must be made for obtaining the additional funds, and in this connection seasonal changes in the money market must be borne in mind.

Summary Operating Budget

Form 92 shows an example of the summary operating budget used by a large public utility company. In other sheets the annual figures here shown are broken down into months and the totals into different departments; still further sheets analyze in much detail these departmental expense amounts. In Form

92 only the total figures of each section are given for illustrative purposes; in practice, of course, the figures for the various departments are filled in.



Local Approval................19... Exhibit 1 Gen. Mgr.	GENERAL OPERATING ESTIMATE - SUMMARY 12 Months Ending. December 31, ... 19 31.... .. ..Company	Concurred in by Exec. Comm. Date Sec.

			Estimate	Previous 12 Months	Estimated Valuation, Per Cent Earned and Investment	
101	Gross Earnings from Operation	Dept.				Department
102		Dept.			Valuation First of Period	
103		Dept.			Estimated % Earned on Valuation	
104		Dept.			Valuation First of Previous 12 Months	
105		Dept.			% Earned on Valuation Previous 12 Mos.	
106	Total Gross Earnings from Operation		43,800,000	42,600,000	Est. Additions to Plant This Period	
107	Operation and Maintenance	Dept.			Additions to Plant Prev. 12 Mos.	
108		Dept.				
109		Dept.				
110		Dept.				Department
111		Dept.			Valuation First of Period	
112	Total Operation and Maintenance		26,200,000	25,600,000	Estimated % Earned on Valuation	
113	Net Earnings from Operation	Dept.			Valuation First of Previous 12 Months	
114		Dept.			% Earned on Valuation Previous 12 Mos.	
115		Dept.			Est. Additions to Plant This Period	
116		Dept.			Additions to Plant Prev. 12 Mos.	
117		Dept.				
118	Total Net Earnings from Operation		17,600,000	17,000,000		
119	Non-Oper. Income	Earnings from Subsidiaries	8,600,000	8,500,000		Department
120		Inter-Company			Valuation First of Period	
121		Fiscal Agent			Estimated % Earned on Valuation	
122		Others			Valuation First of Previous 12 Months	
123	Net Earnings of Company		26,200,000	25,500,000	% Earned on Valuation Previous 12 Mos.	
124	Less Underlying Bond Interest		5,100,000	4,800,000	Est. Additions to Plant This Period	
125	Earn. Applicable to Gen'l. Mtge. Interest				Additions to Plant Prev. 12 Mos.	
126	Less Gen'l. Mtge. Bond Interest					
127	Earn. Applicable to Other Indebtedness		21,100,000	20,700,000		
128	Other Interest	Inter-Company				Department
129		Fiscal Agent Account			Valuation First of Period	
130		Others			Estimated % Earned on Valuation	
131		Bond Discount & Expense			Valuation First of Previous 12 Months	
132	Total Other Int. & Bond Discount		2,900,000	2,800,000	% Earned on Valuation Previous 12 Mos.	
133	Net Profits		18,200,000	17,900,000	Est. Additions to Plant This Period	
134					Additions to Plant Prev. 12 Mos.	
135						
136						
137						Department
138					Valuation First of Period	
139					Estimated % Earned on Valuation	
140					Valuation First of Previous 12 Months	
141	Net Profits		18,200,000	17,900,000	% Earned on Valuation Previous 12 Mos.	
142	Less Reserve		3,100,000	2,900,000	Est. Additions to Plant This Period	
143	Applicable to Pfd. Dividends		15,100,000	15,000,000	Additions to Plant Prev. 12 Mos.	
144	Preferred Dividend		3,000,000	3,000,000		
145	Net to Common Stock		12,100,000	12,000,000		
146	Common Dividend		1,900,000	1,800,000		Total Company
147	Net to Surplus		10,200,000	10,200,000	Valuation First of Period	249,000,000
148	Surplus First of Peroid		22,700,000	12,500,000	Estimated % Earned on Valuation	10.5
149	Direct Entry to Surplus				Valuation First of Previous 12 Months	236,000,000
150	Total Surplus End of Period		32,900,000	22,700,000	% Earned on Valuation Previous 12 Mos.	10.8
151					Est. Additions to Plant This Period	13,000,000
152					Additions to Plant Prev. 12 Mos.	
153						
154						
155						
156						
157						
158						

Form 92: Summary operating budget.

Since this is a rapidly growing business, with constant additions to the fixed plant and equipment, a good deal of attention is paid in this summary both to the comparison with the previous 12 months and also, on the right-hand side of the sheet, to the percentage earned on the value of the net assets. During the period under estimate, for example, it is evident that the company has invested part of its surplus in more plant and has also issued new preferred and common stock for that purpose. The estimate as it now stands shows that, although the net earnings (line 123) are expected to be greater during the coming year than in the previous year, the percentage earned on valuation is estimated at only 10.5 per cent, instead of the 10.8 per cent earned in the preceding year. These are matters to which the management will pay very careful attention, and they will analyze the more detailed figures supporting this schedule to see, first, what is the reason for this decline in the rate of return, and, second, whether there is any remedy for it.

Requirements for Budgetary System

For the successful operations of a budget, certain things are necessary in the general organization of the business.

1. A complete general accounting system must furnish the basic information for the budget; the records for past periods will provide the principal material for estimating the general totals of income and outgo for the coming budgetary period.

2. A cost system, tied into the general accounting records, will furnish the most reliable basis for estimating the costs of producing goods called for in the manufacturing program.

3. Perpetual inventory records of raw materials, of work in process, of finished goods, and of plant and equipment not only will assist in determining the budget figures but will be necessary throughout the budget period for effectively controlling these items and keeping them to the budgeted amounts.

4. Monthly statements of departmental expenses and monthly financial statements prepared respectively by the cost and accounting departments, will supply the data for checking up the budget figures and for revising them when necessary.

5. It is understood that the accounting classification of the general ledger and of the cost ledger must correspond closely with the items of the budget estimates, both to facilitate the preparation of the original estimates and also to enable them to be subsequently compared with actual figures.

6. A definite plan of operations must be worked out before any budget can be prepared; the function of the records will be to attach money values to the plan.

Some Specific Cases

It has already been mentioned that a budgetary procedure must always be adapted to the special needs of the particular business. This will relate not only to the form in which the budgetary estimates are prepared but also to the organization through which they are prepared. This can best be illustrated by giving some notes on a number of examples for different types of industry, based upon actual cases.

An Engineering Budget

A public utility such as a gas or electric light company, a telephone or water company, situated in a growing community, must make very careful plans for its future development. It must estimate the probable rate of growth of the district it serves and must endeavor to determine as closely as possible the specific neighborhoods in which the growth will take place. For this purpose, surveys have been made in many cases for 5 years ahead and sometimes for 10 years ahead. The planning of these future developments is not only an economic and statistical matter, but engineering advice will also be needed. Furthermore, as soon as the general lines of development have been determined, it becomes an engineering matter to make the plans for carrying them out. The necessary drawings will be prepared, and estimates set up for the cost of the proposed additions to both the producing and distributing plant. Included in this statement of plans should be the engineer's report, giving his reasons for the recommendations which he is making, expressed with sufficient fullness to enable the general management to judge of their wisdom.

In such circumstances, the regular operating budget of the business will also be prepared largely by the engineering staff. With this will be combined the budget for materials and supplies and the financial budget already described. In this way a complete program for the future operations of the public utility will be set before its directors, in terms which will enable them to come to definite conclusions about their expediency.

Engineering Expense of a Manufacturer

One of the most difficult parts of a manufacturer's expense to deal with is the expense of the engineering department, because such expenses are mostly incurred for purposes not directly and immediately connected with current manufacturing operations; they are for research and development of new products, for improvement in existing products, for research and development of manufacturing processes, and for any sort of improvements they can develop, either in products or in the methods of manufacturing them. Such expenditures are difficult to plan and budget in advance and also to apply later in the cost distributions; but this is all the more reason why they should be carefully considered. For example, it has sometimes happened that engineering expense was found to apply in the proportions of 75 per cent to special products and 25 per cent to regular standard products, although in volume of sales special products were less than 20 per cent of the total, and standard products were more than 80 per cent. Such a condition may not come readily to notice unless careful cost analysis of these expenses is made, allocating them according to the objects sought for; and when such a condition has been discovered, every effort should be made to remedy it. In some cases the management has been successful in completely reversing these undesirable situations, reducing the excessive expenditures devoted to special work, and appropriating the larger part of the available funds to the development and improvement of the standard products of the company. This is a much sounder business condition, since it is aimed in the direction of giving reliable products of good value to the main body of the company's customers.

Budgeting Plant Layout

Another class of expense which comes irregularly and is therefore difficult to budget is moving expense and expense of rearranging departments or machinery within a department. Here again the budget should include careful examination of past expenditures, to see what has been the purpose of them, and careful planning of future expenditures to be sure that good value is obtained. It is particularly important that a long-time view should be taken, and a long-time plan adopted;

otherwise there are likely to be continual moving and removing of machines and departments, excessive expenditures will be incurred, and only poor results obtained. Very many plants have grown up piecemeal and not with the most economical layout, because future requirements could not be foreseen; in such cases, and also because of the natural growth or change of the business, there are likely to be frequent shifting and adjustment. Wherever this occurs, an ideal plan and layout should be prepared on paper for the whole plant; this may never be realized or may be put into effect only after many years; but whenever machines and departments are reorganized or moved, the changes should be made in accordance with this general plan. In this way there will be a minimum of unnecessary moving, and the moves which are made will be the most effective.

A Manufacturer of Standard Lines

Manufacturers of standard lines, such as automobiles, automobile tires, metal work, and other products widely distributed over the country usually begin their budget operations with a detailed analysis of their sales, classified along geographical lines. Complete surveys are made of the territories which they serve or expect to serve. Adopting as a unit some geographical area, such as the county or township, as much information as possible is gathered as to its population, its buying power in terms of the company's products, and the amounts of the company's new sales for past periods. The company then determines the percentage of the total business of the country which it may expect to do in its own line, and this percentage, with variations to suit local conditions, is applied to all the local areas. On this basis a sales budget is prepared; the subsequent procedure is designed, as before described, with a view to the execution of the sales budget.

An Accounting Budget

In the case of many small firms it is possible very quickly to construct a simple budget by classifying expenditures into fixed expenses, variable overhead expenses, material cost, and labor cost, and by stating these as percentages of the total sales. Fixed expenses will, of course, remain constant throughout, but other charges will vary practically in proportion to sales, provided they do not exceed the capacity of the plant. It is then possible to calculate the profit or loss which will result from operating at any particular percentage of capacity. If the proprietors can estimate with reasonable accuracy the amount of business they expect to do, they can outline the main elements of a budget from the accounting computations, with sufficient definition to indicate the probable profits, and to serve as a check upon their subsequent activities.

Flexible Budgets

Even closer adaptation of expenses to the volume of business has been attempted in some cases by setting up ranges of operating activity, such as to determine a normal volume which will be called 100 per cent, and then to list a series, such as 65 to 75 per cent activity, 75 to 85 per cent activity, 85 to 95 per cent activity, and so on. For each of these ranges a separate set of budget figures has been prepared, dealing with the items of manufacturing expense, it being assumed that direct labor and direct materials would vary exactly with the percentage of activity. One advantage of this sort of budgeting of overhead expense is the pressure it places upon these items to follow the volume of business, instead of remaining unaffected by changes in volume, as they tend to do. The amount of detail into which a plan of this sort should go must always be decided according to the practical results which can be obtained from it.

From a management point of view, flexibility in the budget is greatly to be desired. Some able business men have come to regard a budget with suspicion and dislike because, they say, there is a tendency in an organization which has adopted a budget to cease from constructive planning, and to suppose that all exercise of enterprise and making of further plans are at an end. In other words, cases have occurred in which a budget was like a dead hand over a business, leaving it rigid and unable to adapt itself to new conditions. Continued alertness to meet new conditions and to put into effect new and progressive policies are essential in any business; if the budget is to continue to be a part of active management, it must satisfy all these requirements.

Revision of the Budget

It is not essential that the budget should remain unchanged for any given period; on the contrary, provision should be made for revising it as often as may be needed. A variety of practice is found in this respect; the budget may be prepared for a year but broken down into monthly, two-monthly, or three-monthly periods, the later periods being perhaps prepared only in outline or main totals. As each short period passes, the detailed budget for it would be dropped, the outline for the final period filled in with the details, and another period added in outline at the end. At each of these times the opportunity could be taken to revise the budget figures in any way that may then be found necessary. Still another plan is to have a double budget, a maximum and a minimum, preparing them within narrow limits so that either one or the other is likely to turn out to be very close to the facts.

Final Statements in Budget Period

The budget is not complete unless it includes an estimated income statement showing the income and expenses of the business as they will be for the budgeted period if the budget is carried out according to schedule, and a balance sheet as of the last day of the budget period indicating, with the same proviso, the condition of the business as it will be on that date. These statements provide a final test as to whether the plans laid down in the budget will have a satisfactory issue, and whether the company will be in sound condition after they have been carried through.

Concluding Remarks

It has been found in practice that a budget is useful in proportion to the care and accuracy with which it is first prepared to fit the actual plans of the operating departments, and the diligence with which it is followed up and revised by comparison with reports showing actual conditions. Since it is to serve as a standard for measuring the performance of the various officers and departments, care must be taken that no padding of the figures is allowed for the purpose of afterwards making a favorable showing by doing better than the budget. It is of the utmost importance that the budget should serve as a basis for cooperation among the department heads, instead of each one being left to his own devices, without communication with his colleagues, and sometimes without the knowledge of his superiors. The presence or absence of team-work in a business will be directly reflected in its financial results; a budgetary procedure provides a regular means of promoting such team-work, and of reviewing each man's part in the general plan, without the irritation which is caused when these matters are made the subject of special investigation.

QUESTIONS AND PROBLEMS

1. What would be a reasonable budgetary procedure for a company manufacturing men's clothing, and having two main selling seasons a year, one in the spring and one in the fall? Outline your suggestions briefly.
2. What would be the probable relations between cost accounting and budget making in a manufacturing company, especially (*a*) in making the plans, and (*b*) in reporting upon them?
3. What are the principal benefits to be derived from the operation of a budget in business?
4. Why should an estimate of sales be the usual first step in preparing a budget? Is this estimate necessarily the finally accepted basis for the budget? Explain your answer.
5. On page 435 it is stated that the Bell Telephone Companies spent $400,000,000 on construction and replacements, of which $150,000,000 was net additions to plant accounts. Explain exactly what this means, in terms of probable changes in all the various accounts affected, and state what would be the nature and disposition of the other $250,000,000.
6. Outline a budget procedure for any kind of business with which you are familiar. Describe the information you would require and the forms of reports you would set up to cover the manufacturing, financial, and selling operations.
7. Would there be any value in budgeting for a loss during a period of business depression? Explain.
8. What problems might develop in the preparation and operation of a budget with reference to the personalities involved? What methods would you suggest to overcome these difficulties?

XXIV

COST ACTIVITIES OF TRADE AND PROFESSIONAL ASSOCIATIONS

Objects of Trade Associations

One feature of business life in recent years has been the growth of associations designed to promote the general interests and welfare of all the members of a given trade or profession. It is often said that the development of these associations registers a change in business sentiment from a competitive era to a cooperative era, and that there is more of a spirit of mutual helpfulness than before. This is true, but it is also true that it is competitive conditions which have made these associations necessary; in days when competition was largely absent, and problems of production to satisfy the market were the chief anxieties of business men, there was little occasion for much discussion looking to a better regulation of the industry. In these days, however, the keenness of competition and the fact that distribution problems weigh heavily upon business have brought about conditions in which it became essential that some form of common action be taken to preserve the common welfare; otherwise the conditions threatened to become destructive for all; not only the industry itself, but the public welfare as well would be jeopardized. Trade associations accordingly developed within the several industries; these associations have sought to spread knowledge of manufacturing methods and trade practices, to develop ethical standards of conduct within the industry, sometimes to undertake advertising campaigns for the industry as a whole, to study legal and governmental matters, to discuss labor relations as they affect the industry, and to undertake any activities which promised profit or improvement for the members.

Trade Associations and Cost Accounting

Among these various activities one of the most prominent has been the attempt to develop better accounting practices within the industry; it has been recognized that adequate recording and reporting of financial and operating facts will go a long way toward a clear appreciation of the needs and problems of the industry. For many years these associations have, therefore, to a surprising extent, undertaken the development of uniform accounting and cost methods by which their members might follow the same rules and principles in keeping their records and making their reports.

It is recognized in particular that the worst forms of competition arise from ignorance of manufacturing and selling costs; manufacturers in this situation will offer prices which cannot, possibly yield a net profit, and the condition of the industry is seriously impaired. Some industries are especially characterized by the presence of large numbers of small manufacturers who are likely to pay little attention to costs, and as a result jeopardize the success of everybody in the business. The larger manufacturers have a genuine dread of competition originating in such sources, and one of their most effective means of combating it has been the development of cost-keeping methods which would tend to removing the prevailing ignorance. This aspect of the matter becomes more important with the constant increase in the use of labor-saving machinery in manufacturing, since this means a reduction in the direct labor charges and an increase in the overhead. When no reliable cost records are kept, the management is likely to be aware of the direct material and labor cost of the product; it is the effect of overhead on the costs which is usually overlooked.

Extent of Use of Uniform Cost Systems

For these reasons the adoption of some form of cost accounting activity by associations of manufacturers has been widespread. There are between 600 and 700 such associations in this country, and of these probably nearly half have developed and published some form of uniform cost system. There has been no recent survey of the extent to which these systems are actually used by the members of the association; when such a survey was made several years ago it was found, from the returns of 24 associations, that out of a total membership of about 15,000 member companies some 4,000 members were using the cost system put out by the association. In addition to these about 1,000 other companies, not members of the association, were using the system. This means that about 27 per cent of the association membership had adopted the uniform system; but if the volume of business done were considered, it was found in many cases that the members who were using the system represented anywhere from 70 to 90 per cent of the business done. In other words, it is a matter of general observation that the most intelligent units in any given industry are members of the association, and the most intelligent members of the association are using the up-to-date cost accounting methods developed by the association. Furthermore, in some associations the proportion of members using the uniform cost system has increased from 25 to 75 per cent of the total membership during the last six or seven years.

Organization for Developing a Uniform Cost System

When a trade association desires to undertake the development of a cost system for recommendation to its members, the first step, after due discussion, will usually be the appointment of a committee to carry out the work. This committee should be large enough to be representative of the industry but small enough to get the work done; it should include the accounting officers of typical members of the association, but it should also include one or two executives. In many cases the committee has with advantage called in the services of a professional consultant who has had experience in the industry, and this assistance has usually resulted in a more effective and satisfactory system being evolved.

The committee will then begin to work by studying the present practices in use by the companies which they represent, and by other companies to whose records they can gain accesss. They will in all likelihood discover a wide divergence in practice, and it will be by studying these and coming to some common agreement about them that they will be able to create a system and procedure which will be satisfactory to the general membership of their association.

Essentials of a Uniform System

It is not necessary that a uniform system should aim to provide exactly the same procedure in detail for all members of the industry; in fact the committee will have to begin by recognizing that such uniformity is impossible. What is necessary is that they shall come to an agreement on general principles, that is, an agreement as to the accounting classification and disposition of the various asset, liability, income, and expense items involved in carrying on the business. For this purpose the committee may well begin by drawing up a balance sheet and operating statement which will be satisfactory to the members; the development of these statements will occasion a good deal of discussion, but the result will be an agreement as to the major questions which will be in controversy. The arrangement of the operating statement will, for example, involve questions of the treatment of expense items as between manufacturing, selling, and administrative costs. From these statements it will not be difficult to draw up a list of ledger accounts to provide the information necessary for preparing them. These accounts will have to be defined as to their meaning and content and the discussion of these definitions will immediately bring to light another series of differences of opinion, which also will have to be composed in a way to meet the needs of the largest number. The committee might next undertake the preparation of any forms of report, other than the balance sheet and operating statement, which might be needed in the industry. When this stage has been reached, all the essentials of a uniform system have been created; it will, however, probably be desirable for the committee to work out forms of books of original entry, such as the voucher register, cashbook, and purchase and sales journals, which will best facilitate the detailed gathering of the records from day to day. But it will have to be recognized that it is at this stage that the detailed differences of organization, products, and manufacturing practices as between different companies will most assert themselves, and where the greatest amount of adaptation of any system to the needs of individual companies will need to be made. In spite of this, many associations have found it desirable and practical to include forms for the books of original entry in their uniform systems.

Probably the greatest difference between companies to be taken into account is that of mere size; both in the list of ledger accounts and in the forms for the books of original entry, the larger companies will require much greater subdivision than the smaller companies. To meet these needs some associations have drawn up two or even three different lists of ledger accounts, with corresponding books of original entry. In these cases the main thing to provide for is that the classifications of the different accounts should coincide for the different sizes of business, in order that several accounts in more detailed schedules may add up to a total which is comparable to some one account in the briefer schedules. In this way it will still be possible to compare figures throughout the industry, and this is one of the main objects of the uniform system.

Inducing Members to Use Uniform System

After the uniform system has been developed and circulated, it becomes necessary to induce the membership of the association to install it in their offices and plants. This is not always an easy task; the more progressive plants will already have systems in operation which will more or less resemble the uniform system which has been developed; the less progressive members will not readily change their methods, especially in the direction of a more expensive system. It therefore devolves upon the association to take such steps as are found feasible to persuade members to adopt the system; in official communications from the secretary and in the association meetings, the advantages of the system will be constantly emphasized. The most effective work is done, however, when the association employs competent assistants who can visit any members' offices and assist in the necessary adaptation of the system to the individual needs of the members. This has been done in most of the associations which have been very successful in having their systems adopted by their membership.

Collection of Data from Members

A uniform system reaches its highest usefulness within an industry when general statistics are gathered from a considerable number of companies within the industry, from which summaries and averages may be prepared for the guidance of members. This represents a considerable advance over the adoption and installation of a uniform system within member plants, and the number of associations carrying on this activity is less than the number which have developed uniform systems; members who may be quite willing to use the uniform system are often reluctant to disclose any of their own figures. Their objections arise on two main grounds, first, fearing the disclosure of their figures to competitors, and, second, a doubt as to the usefulness of the service.

With regard to the former, members are entitled to assure themselves that adequate provision for secrecy has been made, before they furnish their own figures to a central office. Where leading members of an industry are officers of the association, there is, unless careful arrangements are made to the contrary, a possibility that they may have access to returns sent to the secretary's office. Such a situation would, of course, be objectionable, but associations are usually able to make provision against it. Definite steps must be taken in this direction before members can be expected to send in their figures. In several cases the problem has been dealt with by utilizing the services of some professional firm or organization, quite independent of any of the members, to gather and compile the figures.

The doubt as to the usefulness of the undertaking arises in various forms; a company often feels that its business is sufficiently different from the others to make comparison impossible; it may also for the same reason believe that the general figures which it might receive from the association office would be of no practical value to it. While it is true that, in reading these general statistics, allowance must be made for differences in organization and policy of individual firms, yet generally it is found that the individual firm stands to gain much by having the general figures of the industry as a check upon its own figures. Business success is often achieved by a company following an independent line of policy, which will naturally occasion differences in its income and expense items from the average figures of the industry; when these differences are observed in the returns, they will be such as would have been expected and will be susceptible of an explanation which will be satisfactory to the company management. It is, however, likely that they will observe other differences which they had not expected and which might serve to warn them of undesirable conditions in their own plant and wasteful expenditures of which they were unaware. If, on the other hand, they discover that they have certain advantages over competitors, that information also is of interest.

Specific Product or Operation Costs

In order to make the association figures of service, care must be taken in defining the facts to which they relate. In showing the cost of a product, for example, the product itself must be standardized in specification; there is no point in comparing the costs of a cheap paper with those for an expensive paper. In order to make the figures serviceable, a standard specification for the product should be agreed upon among those who are to contribute figures relating to it; in some cases standard operations may be agreed upon, around which costs may be gathered. In the printing industry, for example, it is customary to compute the hourly costs or such operations as hand composition, linotype composition, printing on job presses, and printing on cylinder presses of different sizes. The United Typothetae of America, an association of printers, therefore puts out a report like Form 93 every year, together with much other information. The lower part of this form shows the average costs for these operations during 1932 as taken from the actual costs of a number of reporting companies. The upper part of the report shows the percentage of each item of expense which enters into the make-up of these hourly rates.

Legal Status of Gathering and Summarizing Data

At one time there was considerable question as to the legal propriety of thus gathering and circulating cost summaries and averages. The Federal Trade Commission became interested in the activities of some trade associations, and in other cases actions were brought to enjoin proceedings, on the ground that they were contrary to the federal antitrust laws. Considerable confusion was injected into the situation, especially by the decision of the United States Supreme Court in the American Hardwood case,[1] in which certain practices of the Hardwood Association were definitely condemned by the court. Further study of that case made it

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[1] *American Column and Lumber Company et al.* v. *United States of America*, 257 U. S. 377.

RATIOS OF DEPARTMENT EXPENSES, HOUR COSTS, AND PERCENTAGES OF PRODUCTIVE TIME*
(From 1932 Composite 9-H Cost Statement)

Classifications	Percentage Ratios		
	Composition Hand Work	Slug Casting Machine	Monotype Keyboard
Number of Reports in Each Factory Department	141	61	38
Rent and Heat	3.38	1.35	1.19
Insurance	.43	.62	.29
Taxes	.32	.56	.27
Depreciation	6.53	7.05	3.20
Interest on Investment	2.87	4.07	1.75
Wages	41.10	45.51	54.11
Light	.23	.09	.10
Power	.00	.55	.20
Spoilage	.09	.01	.17
Departments Direct Supplies and Expense	2.33	4.59	2.96
Machine Metal Waste	.00	.61	.00
All Factory Direct Expense	57.28	65.01	64.24
General Factory Expense	7.44	7.49	8.54
Total Factory Expense	64.72	72.50	72.78
Plus Machine Cast Type and Materials	2.70	.00	.00
Minus Machine Cast Type and Materials	.00	.05	.00
Net Factory Expense	67.42	72.45	72.78
Commercial Expense	12.09	10.43	10.56
Selling Expense	14.75	11.81	11.57
Stock Storage and Handling, Packing—Shipping and Delivery Expense	5.74	5.31	5.09
Total Departments All-Inclusive Cost	100.00	100.00	100.00
	Costs per Chargeable Hour		
Wage Cost	$1.641	$1.792	$1.876
Fixed Expenses Cost	.540	.537	.232
Other Factory Expense Cost	.404	.525	.415
Total Factory Cost	2.585	2.854	2.523
Plus Machine Cast Type and Materials Cost	.108	.000	.000
Minus Machine Cast Type and Materials Cost	.000	.002	.000
Commercial Cost	.483	.411	.366
Selling Cost	.589	.465	.401
Stock Storage and Handling, Packing—Shipping and Delivery Cost	.229	.209	.176
Total Departments All-Inclusive Cost per Chargeable Hour	3.994	3.937	3.466

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* Abridged from 1932 *Ratios for Printing Management*, published by United Typothetae of America, 1933.

Form 93: Composite statement on printing costs.

clear, however that the practices condemned were concerned entirely with the gathering and dissemination of certain *sales* statistics and in particular with agreements to act in collusion in some aspects of their sales policies; the decision had nothing to do with cost accounting practices or information.

The air was considerably cleared by a correspondence between Mr. Hoover as Secretary of Commerce and the Attorney General's Department. In the course of this correspondence it was clearly brought out that the use of uniform cost systems by the members of an association and the gathering of figures which might be used for the general information of members were not only permissible but commendable. It was pointed out that the legal dangers were in going a step further and making such information the basis for any common agreed action with regard to selling prices or other parts of sales policy.

The last authoritative pronouncement on the subject was the United States Supreme Court decision of June, 1925, in the case of the Maple Flooring Manufacturing Association. In this decision Mr. Justice Stone carefully made the distinction which has been stated above, between collusion to enhance prices and to bring about restraint of trade, and the collection and dissemination of statistics without any such collusion, in the following words:

> We decide only that trade associations or combinations of persons or corporations which openly and fairly gather and disseminate information as to the cost of their products, the volume of production, the actual price which the product has brought in past transactions, stocks of merchandise on hand, approximate cost of transportation from the principal points of shipment to the points of consumption, as did these defendants and who, as they did, meet and discuss such information and statistics without however reaching or attempting to reach any agreement or any concerted action with respect to prices or production or restraining competition, do not thereby engage in unlawful restraint of commerce.

This decision will doubtless stand for the protection, on the one hand, of trade associations legally engaged in spreading correct information and ideas among their membership and cultivating an intelligent point of view and, on the other hand, of the public against illegal associations endeavoring to defeat the purposes of the anti-trust legislation.

It is clear that under N.R.A. the government attitude toward uniform cost accounting has become still more sympathetic;

but there is no more tendency than before to encourage price agreements among producers. The movement for open or posted prices is, however, likely to have somewhat the same results, in that a seller will hesitate to cut prices if he has to make those prices known to the industry.

Advantages of Uniform Cost Systems

Some of the advantages of uniform cost systems have been referred to in dealing with the objections to their use. Within an industry a uniform system is likely to have the same sort of beneficial effects as a sound system in an individual company; that is to say, it affords clear and definite information of facts and conditions instead of vague and probably erroneous impressions; it thus leads to the formation of sound opinions and wise policies; the general level of intelligence within the industry is raised.

Another advantage is that the various members of the association will, through the medium of the uniform accounting system, all learn to speak the same language; when they use accounting and statistical figures relating to the operations of their business, they will use them on a comparable basis and will thus avoid the misunderstandings which constantly occur among members of an industry who have not yet agreed upon a uniform accounting procedure. Much time and effort are thus saved in the discussions among members.

But the greatest benefit will always consist of the tendency which will be created among members who are fully and correctly informed as to their operating costs, to avoid the excesses of ignorant competition. The experiment has several times been tried of seeking quotations for a piece of equipment from a considerable number of manufacturers, and the divergence between these quotations has been extraordinary; the figures which have been sent in as bids on the identical piece of equipment have varied as much as 40 per cent above and below the average quotation. It was clear either that some members of the industry must be extraordinarily inefficient as compared with others or that those making the lower quotations were entirely ignorant of their costs. In either case it is desirable for the welfare of the industry that the facts be known, and a uniform cost system is the best medium yet devised for that purpose.

Trade Associations and N.R.A.

The Industrial Recovery Act of 1933 and the administrative measures set up under it have greatly strengthened the activities of trade and manufacturing associations. These associations have been given official recognition, where they really represent their industries, and have been constituted the proper bodies to formulate the industry codes of fair competition. The relations of government to business are discussed more fully in the next chapter, but it may here be pointed out that these relations at present operate largely through the agency of the trade associations, which are thereby afforded a great opportunity to render useful service to their respective industries and to society as a whole. All activities of the associations have received an added impetus, and they are destined to play a larger part in our economic society, if only they can rise to the occasion.

Among other things the cost work of the associations has assumed added importance by reason of the prohibitions on selling below cost. The preparation of uniform accounting systems and the gathering of statistics of cost from members, to serve as a basis of judging what are fair prices and fair competition, have become essential parts of the government plans.

Professional Associations

In addition to the associations formed by members of a given industry or trade, there are a number of associations of professional men or of men engaged in various phases of industrial accounting. These associations are interested in the advancement of good principles and practice in industrial accounting work, primarily in the belief that these will contribute substantially to the success of any industry to which they may be applied. The student of cost and industrial accounting should be acquainted with the general character and work of these associations, and with this intent the following paragraphs have been written describing them. The activities and progress of cost accounting are best reflected in the publications of these associations; as in manufacturing associations, the leaders in the professional field also will usually be found active in their appropriate associations.

National Association of Cost Accountants

The association which is most closely identified with industrial accounting is the National Association of Cost Accountants, which is actively interested in all phases of accounting for manufacturing, distributing, and financial business organizations. In addition to the national board and officers, who look after the activities of the entire Association, there are some 45 local chapters, each with its own organization.

One of the main activities is the annual convention, at which papers are read on the questions which are found to be of greatest interest to business men in this field; these papers, together with the discussion on them, are afterwards published in the Yearbook of the Association. The chapters hold monthly meetings, at which also subjects of importance are presented and discussed.

Other publications of the Association include a series of fortnightly bulletins, each of which is a monograph on some aspect of industrial accounting; another series of bulletins deals with the activities of the Association. Still a third series, published monthly, affords a reference list of articles and books which have appeared on cost accounting and allied subjects.

The Association maintains a library, and a research department endeavors to supply reliable answers to any questions which may be put to it by members.

American Institute of Accountants
The American Society of Certified Public Accountants

These two societies draw their membership from the public accounting profession and interest themselves in all the activities of that profession. In so far as public accountants engage in the installation of cost systems, in giving advice on the internal control and organization of accounts, and related subjects, each of these societies is likely to reflect those activities in its meetings and publications.

Membership in the American Institute of Accountants is secured by public examinations administered by the Institute itself; membership in The American Society of Certified Public Accountants is restricted to certified public accountants who hold valid certificates as such granted by the states, other political subdivisions, and the possessions of the United States of America. Both societies devote much attention to questions connected with the duties and responsibilities of public accountants in relation to their clients, to legal questions affecting accounting practices, and to the improvement of the status of the profession generally.

The American Institute of Accountants publishes *The Journal of Accountancy* monthly; in addition it has brought out a number of books, including especially the *Accountants' Index*, an exhaustive bibliography of all accounting literature. The third volume of this work brings the Index down to December, 1931, and the Institute is continuing its compilation.

The official journal of The American Society of Certified Public Accountants is *The Certified Public Accountant;* like *The Journal of Accountancy* it contains technical articles on accounting subjects and articles dealing with the other matters enumerated above.

American Management Association

As its name implies, the American Management Association interests itself in all types of business management problems. Its membership is drawn from all types of business, and its activities are subdivided into groups which correspond approximately to the main departments of the member companies. The publications and meeting subjects are classified on the same basis, so that it offers, for example, publications on financial management, marketing, office management, and production. In all of these are found items relating to cost control and analysis; for instance, among the publications for production executives are a considerable number on the subject of extra incentive wage plans. Papers on budgeting appear in all of the groups.

In addition, the Association holds an Autumn Convention in the Middle West and a Spring Convention in the East, devoted to general management problems, including personnel, budgeting, organization, compensation of executives, and research. The Association publishes several magazines, in addition to its pamphlet series.

The Taylor Society

Named after F. W. Taylor and formed to promote understanding of his teachings, the Taylor Society interests itself in all efforts to improve the effectiveness of methods of management—general administration, finance, production, distribution, and industrial relations. It describes itself as an international society to promote the science and the art of administration and management. Recognizing that cost accounting is one ultimate measure of the success of any plan of scientific management, considerable attention has been given to it by the Taylor Society. The Society holds at least two national meetings each year, and monthly meetings are held by the local sections which are found in all the chief industrial parts of the country. The bulletins of the Society, published monthly, contain many articles of interest to cost accountants. Its membership includes industrial executives, engineers and students of social institutions.

The Society of Industrial Engineers

Formed during the war as an agency for promoting efficiency in production, The Society of Industrial Engineers seeks to promote efficiency and economy in governmental as well as in private business, to further effective coordination of the various functions of management, and to eliminate waste. The Society holds one, and sometimes two, national conventions a year, and the 14 or more chapters of the Society hold meetings at least once a month in the chief business cities of the country. The character of the principal activities of the association is largely indicated by the committees which have been formed. These include committee on elimination of unnecessary fatigue, committee on standard management terminology, committee to study practical methods for the elimination of waste. The last is divided into seven sections covering, respectively, management, manufacturing, labor, office, distribution, natural resources, and government. There is also a maintenance committee, charged with the compilation of a handbook for the use of plant engineers, plant superintendents, and maintenance engineers. A number of other committees deal with technical subjects connected with production, such as time studies, engineering standardization, and wage incentive plans.

The American Society of Mechanical Engineers

The American Society of Mechanical Engineers is a large and influential association, made up chiefly of men interested in engineering as such but extending its scope to all aspects of efficiency in production. In addition to two meetings a year of a national character, local sections of the Society hold meetings in 68 large centers of population. The Society issues a very extensive list of publications of its own, and also compiles *The Engineering Index*, a valuable index of current engineering literature in all the principal magazines. It publishes the *Engineering Magazine*, a number of special volumes on technical and mechanical topics, and *Transactions* classified under some 16 professional division sections, corresponding to the main activities of the Society. Among these sections the *Transactions in the Management*, *Machine Shop Practice*, and *Materials Handling Series* especially contain frequent papers of interest to cost accountants; all the other sections afford reliable and up-to-date information on engineering developments in manufacturing and transportation.

QUESTIONS AND PROBLEMS

1. Why should cost accounting be one of the most common activities in which associations of manufacturers have interested themselves?

2. The E. T. Lewis Company are manufacturers of paper boxes and have been invited to cooperate with the National Association of Paper Box Manufacturers in their cost accounting work. The association has worked out a uniform cost system, and the E. T. Lewis Company is considering the question of installing this system in its plant and of furnishing figures to the association. In exchange the association would supply average figures to the company for all companies contributing, thus enabling the E. T. Lewis Company to compare its individual figures with average figures.

The E. T. Lewis Company believes that its business is different from others in that they use different methods of manufacturing and make a special type of box.

In these circumstances what advantages would there be to the company to cooperate with the association? What safeguards should the company desire before agreeing to cooperate?

3. A committee has been appointed by a manufacturing association to prepare a uniform cost system for recommendation to members. In the course of their investigations, preparatory to working out the system, the committee ascertains the following facts:

STORAGE COSTS

Some companies in the industry treat storage cost on finished goods as manufacturing expense, and other companies as selling expense; in both cases the companies have supplied arguments in support of their practice.

INTEREST ON INVESTMENT

A few companies in the industry are charging themselves with interest on their investment in manufacturing plant and inventories; several other companies are charging interest on the investment in fixed assets alone; the majority of companies are not charging this item at all.

MATERIAL HANDLING

In a few companies the cost of handling raw materials, such as inward freight, raw materials stores costs, and costs of the perpetual inventory department, are added to the cost of materials and treated as direct expense; in the majority of cases, however, these expenses are included in the general manufacturing overhead.

How should the committee go about determining a uniform practice which they can recommend to the association in the case of each of the items discussed above? Give arguments and reasons in connection with them.

4. In the cost accounting activities of an association, which do you believe to be more important, (*a*) the development of uniform methods of accounting or (*b*) the compilation of average cost figures for comparative purposes?

5. Is there any difference between a trade association and a professional association? Explain. Have they a different relation to cost problems?

6. What might be the advantage of joining a trade association for each of the following companies:

a. A low-cost producer?
b. An average-cost producer?
c. A marginal producer?

XXV

COSTS AND THE GOVERNMENTAL CONTROL OF BUSINESS[1]

Tendency to Increase Governmental Control

A greater interference in and control of industry by governments and governmental agencies is one of the outstanding tendencies of our times; it is declared to be in the interests of the people at large and against private interests of a predatory or antisocial character. The policy is not a new one in the world; in the Middle Ages the commerce and industry of practically every country, and indeed of every district, were controlled and regulated to a degree which it is difficult for us now to picture. With the coming of the great mechanical and scientific inventions of the industrial age and the growth of the capitalist system, it was felt that these old restrictions operated to prevent mankind from coming into the full enjoyment of its new heritage, and in European countries the nineteenth century was largely engaged in sweeping them away. Those Europeans who migrated to this country left most of the restrictions behind them. The policy in general was a wise one, and our well-being has been greatly enhanced as a result of it.

But after 150 years of the industrial age it is now found that it will not, in its own spontaneous operation, minister fairly and uniformly to the well-being of the people. In particular it is seen that competition, far from leading always to the production of more goods for the enjoyment of the people, is often a disastrous and destructive force, and the cry again goes up for governments to intervene with measures designed to eradicate the evil tendencies, and to assure to the people at large a more equal enjoyment of the good things made available by modern science and invention.

We need not look to the Russian experiment to illustrate the point. That experiment is the outcome of intolerable political conditions rather than of economic conditions, and our own experiments are not likely to take that form. But our experiments are already far-reaching enough, and it cannot but be constructive to reflect upon our own previous history and that of our progenitor nations. On the one hand, it is certain that governmental regulation is going to be greater in extent than and different in character from what it has been in the recent past. The sufferings of large numbers of our people have been sufficiently great and their sense of their own political power is sufficiently keen that it is impossible to suppose that they will not make constant attempts to improve their conditions. On the other hand, nobody who has a sense of history or of social organization will advocate a return to anything approaching the conditions of the Middle Ages. To bind ourselves again with the fetters from which we have so recently shaken free would indeed go far to prevent us from enjoying a standard of living made possible by advances in the physical sciences and by mechanical invention. To destroy this organization, and with it the results of a century and a half of experience, would probably be even more disastrous than a prohibition placed upon scientific invention itself, for it is through this industrial organization that the results of scientific invention have been made available to the people.

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[1] From *Harvard Business Review*, April, 1934.

In this dilemma, the certainty, on one hand, that more control or regulation will be applied and the certainty, on the other hand, that too much or unwise control will be destructive rather than constructive, the real problem is to discover what forms of regulation and control will be most salutary and will be least inimical to the desired progress of our economic life.

Accounts and Statistics the Basis of Control

In the individual business unit this problem of selecting the wisest and most effective form of control has been largely answered. It has been answered along the lines indicated in this book; that is to say, a definite knowledge of all the material facts surrounding the business problems under consideration is recognized as the first essential for any sound business conduct. In all well-regulated businesses it has become the duty of the accounting and statistical departments to furnish these reliable facts, and the comptroller of the modern corporation has come to be regarded as the man who, on the one hand, is capable of gathering facts and figures so that they present a reliable picture and, on the other, has sufficient business acumen to be able to make sensible interpretations of those figures to his fellow executives. When governmental agencies seek to exercise direction and control over business in general, their experience is bound to be the same; they must have information, complete, reliable, and comparable, or they are sure to be misled into the adoption of erroneous and unwise policies. The essence of control is in sound accounting and statistics.

Experience with Public Utilities

A good deal of experience along this line has already been gathered in connection with the federal and state efforts to regulate common carriers and public utilities. This has been going on actively for some 40 years, though the beginnings date back much further than that. It was the universal experience that very little if anything could be accomplished in the way of effective regulation and control without the aid of reliable records and reports. In nearly every jurisdiction, therefore, under the Interstate Commerce Commission for federal control and under the several state commissions for state control, a uniform accounting and reporting system has been worked out, by which the utilities have been required to keep their records and make their reports to the regulatory authority. A considerable body of precedent and standard practice has grown up in connection with these uniform accounting systems in the space of 10 to 20 years, but even so a great deal is lacking to absolute uniformity of practice. Although standardized forms are used and the same accepted principles supposedly followed, differences of company policy and conditions of operation frequently lead to differences of accounting treatment. But the main thing to observe is that in the absence of any uniform systems of account keeping and reporting the commissions were practically helpless in their attempts at regulation. It is a fair assumption that efforts to extend governmental supervision over all manufacturing and merchandising companies will be similarly handicapped until they have established similar accounting controls; and, of course, the task will be much greater on account of the very much larger number of business units to be dealt with and the immense differences of conditions between industries. At present the efforts to set up industrial codes under the National Recovery Administration are occupying the attention of business men throughout the country; the examples in this chapter will, therefore, be drawn chiefly from N.R.A. experiences. But it must be recognized that the problem is more far-reaching than that. Whether N.R.A. is to be a permanent feature of our industrial life or not, and whatever be the name or form of the governmental organization which attempts to exercise supervision over business, it will have to grapple with this question of the form and content of the accounting reports through which it receives its information, so that the problems here discussed are likely to be permanent problems.

Accounting Provisions in N.R.A. Codes

The specific efforts to regulate business under the N.R.A. are being embodied in the so-called codes of fair competition. A large number of these codes have been adopted by their respective industries and approved by the President. Practically all of them contain provisions relating to accounting and costs. In fact there has been so much talk about accounting under the N.R.A. that many people think that there is a special brand or system of accounting called N.R.A. accounting, which will supplant whatever accounting has hitherto been used. This is not the case. There is no special N.R.A. system of accounting and is not likely to be. What N.R.A. needs is a more universal acceptance of the rules and principles of sound accounting as they are already understood among good practitioners. It is true that there is no universal agreement as to principle and practice even among good practitioners, but a considerable beginning has been made toward a general consensus of opinion; this affords a much better start than could be had by beginning with an effort to gain everybody's acceptance of a brand-new system.

The general character of the accounting provisions in industrial codes is well illustrated in the code of the electrical manufacturers, from which certain sections are quoted below.

Requirement on Filing Accounting and Statistical Reports

One of the standard provisions in all the codes is that which requires the filing of accounting and statistical reports in standard form with some central office of the manufacturers' association. The National Electrical Manufacturers Association code provides that the form of report shall be as provided either by the governing body of the association or by any recognized stock exchange. The full clause is as follows:

> V. . . . With a view to keeping the President of the United States and the Administrator informed as to the observance or non-observance of this Code and as to whether the electrical manufacturing industry is taking appropriate steps to effectuate in all respects the declared policy of the National Industrial Recovery Act, each employer shall, not less than once in each year, prepare and file with the Board of Governors or the Executive Committee of the National Electrical Manufacturers Association an earnings statement and balance sheet in a form approved by said Board of Governors or said Executive Committee or in a form acceptable to any recognized stock exchange. Each employer shall likewise prepare and file . . . at such times and in such manner as may be prescribed, statistics of plant capacity, volume of production, volume of sales in units and dollars, orders received, unfilled orders, stocks on hand, inventory, both raw and finished, number of employees, wage rates, employee earnings, hours of work, and such other data or information as the Board of Governors or the Executive Committee of National Electrical Manufacturers Association may from time to time require.

Requirement on Uniform Accounting Records

The foregoing paragraph relates only to the filing of reports with some central office of the association, which for this purpose is acting as an agent of government. But it is recognized that all attempts to have these reports prepared on a uniform basis will probably fail unless the internal records are likewise kept on a uniform basis. This is a much more difficult matter than the reports, since record keeping touches the internal conduct and management of the business. Company executives are apt to feel that they are entitled to have their internal records kept to suit themselves, and that the internal accounting reports are essential elements of their management. In the regulation of the utilities the commissions have usually contented themselves with prescribing only the main outlines of the accounting system, in so far as it had a bearing on the reports to be rendered to the commissions. It has been perfectly open to the particular company to keep what records it pleased for the aid of its own management, and they have in fact usually kept much more detailed records than those required under the uniform accounting system.

On this subject of uniform accounting the code of the electrical manufacturers provides as follows:

> Every employer shall use an accounting system which conforms to the principles of and is at least as detailed and complete as the uniform and standard method of accounting set forth in the Sixth Edition of the Manual of Accounting, prepared and published by the National Electrical Manufacturers Association, and a costing system which conforms to the principles of and is at least as detailed and complete as the standard and uniform method of costing to be formulated or approved by the Board of Governors or Executive Committee of National Electrical Manufacturers Association, with such variations therefrom as may be required by the individual conditions affecting any employers or group of employers and as may be approved by the Board of Governors or the Executive Committee of National Electrical Manufacturers Association or the supervisory agency and made supplements to the said Manual of Accounting or method of costing.

Since the association already has a uniform accounting system which is generally accepted and used by manufacturers who are members of the association, this makes it easy for the code to refer to that system as the standard to be aimed at, and in so far as manufacturers are already using it no change will be involved. But the standard cost system still remained to be prepared at the time of drafting the code.

Prohibition of Selling below Cost

The next step will probably be the most difficult of all to administer. Recognizing the evils of indiscriminate price cutting and wishing to maintain a system of fair competition, most of the codes include a clause designed to stop selling below costs. The electrical manufacturers use the following clause:

> IX. No employer shall sell or exchange any product of his manufacture at a price or upon such terms or conditions that will result in the customer paying for the goods received less than the cost to the seller, determined in accordance with the uniform and standard method of costing hereinabove prescribed, provided, however, that dropped lines, seconds, or inventories which must be converted into cash to meet emergency needs may be disposed of in such manner and on such terms and conditions as the supervisory agency may approve and as are necessary to move such product into buyers' hands, and provided further that selling below cost in order to meet existing competition on products of equivalent design, character, quality or specifications shall not be deemed a violation of this Article if provision therefor is made in supplemental codes for any branch

> or subdivision of the industry, which may be hereafter prepared and duly approved by the Administrator.

It is clear that a clause of this kind might be defeated if manufacturers quoted fair list prices based on their costs but then allowed unreasonable discounts or concessions from these prices. The electrical manufacturers association, therefore, adds to the above clauses another provision:

> X. . . . No employer shall sell directly or indirectly by any means whatsoever any product of the industry . . . at a price lower or at discounts greater or on more favorable terms of payment than those provided in his current net price lists . . . and discount sheets.

Problems to Be Met

The task of administering and enforcing these provisions will be a very difficult one and industry will be engaged upon it for years. It is not intended to represent these obstacles as being insurmountable, but it is believed that a frank recognition of them at the outset will tend to their satisfactory handling. Regardless of the order in which these problems may be taken up as a matter of expediency, they may be stated in order of logical importance as follows:

1. A body of principles of accounting and cost finding must be adopted and adhered to. This applies not only within a given industry but among all industries. Such a statement of principles need not be very long but would cover the main features of the accounts and costs and would suggest a settlement of all the common questions of controversy.

2. The report forms on which companies will make their returns to the administrative body of their industry will have to be prescribed and made as uniform as possible. The facts and conditions of different industries will prevent them from using identical forms, but they can use forms which follow the same principles, and which treat the same items in the same way. The electrical manufacturers code states that the report forms must be "approved" by the governing body, which seems to leave it open to the reporting company to use any form it chooses provided it is acceptable to the governing body. This probably cannot continue if a serious attempt is made to administer the code provisions, and a definite form will have to be prescribed for use by all companies.

3. As regards the internal accounting and record keeping of the companies the body of principles referred to in paragraph 1 above will apply, but they should not be drawn so tightly as to prevent individual companies from gathering their own figures and making their own analyses for management purposes. It is quite possible to have a set of books kept on definite principles and looking to the making of standard report forms, without prescribing all the details of the accounts. Another matter to which attention should be paid is the sheer volume of the reports which may be required by government departments or semigovernmental agencies. It becomes a great burden to a business if it has to keep extensive records merely to satisfy government requirements, in addition to all the records required for its own internal purposes. In regard, therefore, to all definite requirements as to reports to be filed or internal accounting methods to be followed, it would be better to make small beginnings along sound lines and to aim constantly to keep the volume of required reports down to a minimum than to require at the outset a voluminous quantity of reports.

4. The next stage in the procedure will be the hearing of complaints against individual companies which have been accused of infringing the provisions of the code. These are likely to turn especially around the provision against selling below cost and will consist of the allegation that the company in question is not operating according to the rules of fair competition, that it is selling below cost, that its operations are demoralizing to the market and injurious to other manufacturers. Presumably facts and schedules will be submitted in proof of these allegations. Then will come the task of interpreting the provisions of the code.

Adoption of Uniform Accounting and Cost Principles

It has already been stated that it would be better not to attempt to create a new accounting system for this purpose but rather to begin by adopting those principles and practices which already have found the most general acceptance. In the matter of balance sheets and income statements there has been a good deal of collaboration for example between the American Institute of Accountants and the Committee on Stock

List of the New York Stock Exchange. Although nobody's recommendations have yet found universal acceptance, there are authoritative and generally accepted practices in this country, approved by the American Institute and other bodies. If modifications are needed, they can doubtless be arranged in conferences between the various interested bodies, but certainly a long step forward will be taken if their findings can be adopted as a beginning.

With regard to costs the National Association of Cost Accountants has been engaged in the formulation of a statement of general principles.[1] Here the difficulties are likely to be even greater than those arising in the financial statements, especially when it is remembered that not only factory costs but selling and administrative costs also must be included. The problem of arriving at the direct costs of a product will occasion little controversy; there may in individual cases be special conditions incidental to the costs of direct materials and direct labor, but they can probably be settled fairly readily. The problem of overhead will cause much more trouble, both as to what shall constitute the overhead and how it shall be distributed. The listing of the items to be included in overhead will especially bring up the question of interest on the invested capital and the basis for the computation of depreciation. These problems have been dealt with elsewhere in this book, but they are bound to arise as prominent problems in any attempt to adopt uniform cost finding. In the matter of the distribution of overhead, the basis of allocation of specific items of expense to departments and products can perhaps be agreed upon without too much difficulty, but the next problem is that of deciding upon the volume of production or the percentage of plant capacity utilized upon which the overhead shall be spread. This is likely to give rise to wide divergencies of opinion. The great differences which can be produced in final cost figures by computing them on a 40 per cent activity as against a 75 per cent activity are well-known. There will also be the question whether this volume shall be decided solely by conditions within the particular company or whether the conditions of the industry as a whole shall be taken as the basis.

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[1] See *N.A.C.A. Bulletin*, Vol. 15, No. 8.

The Accounting Problem Subdivided

It would be well at the outset of any attempt to draft accounting regulations or recommendations to define clearly the subdivisions of the problem. Much confusion has already been caused by talking about several different things without clearly indicating which matter is under discussion. The various stages of accounting work and materials which are likely to be affected by, or contribute to, public regulation are as follows:

1. The internal records of the business; the actual records of its actual transactions, including cost records.
2. The reports to be rendered to the regulatory authority.
3. Accounting and cost schedules which may be submitted as evidence in hearings of complaints as to selling below cost or other alleged infractions of the code.

The Internal Records of the Business

As already stated, a substantial body of accounting and cost principles has been evolved and has received considerable support. In so far as these principles are common to all industries, they probably could be stated in a very few pages, but in given industries their application often gives rise to very grave difficulties. The members of each industry will have to determine what the general principles mean as applied to their conditions, but constant efforts should be made to secure uniformity as between different industries, as far as that may be practicable.

Probably the accountants of the country and their several representative associations represent the most influential nucleus of opinion and practice on the subject. It would be well for anyone attempting to set up accounting regulations or recommendations to consider carefully what these opinions and practices are; to begin with radically different ideas would certainly increase the magnitude and complexity of the task and would not secure better results.

Perhaps the greatest single guiding principle in this existing body of accounting lore is the idea that the main business of the accountant is to record and report exactly what happened, as truly and clearly as he can. There has been some attempt to belittle the function of the accountant as a historian, but the function is of the greatest importance and no good will come from ignoring it. Only confusion and misunderstanding can arise from the failure of the accountant to report the facts accurately and completely. In any regulations, therefore, which undertake to prescribe what the accounts shall show, it is to be hoped that nothing will be adopted which may tend to obscure the record of the actual course of events.

Interest on Investment

This question may be considered in two aspects: first, as an element in business management, and, second, as a factor in records. On the first of these grounds, it is generally agreed that a business normally should recover, in its selling price, enough to cover its costs and give a return on its investment. It is also agreed that, by incorporating this item in the costs, recognition is given to the different amounts of investment devoted to the production of the several products. And further it is clear that, when it comes to gathering figures for a number of companies on a comparable basis, certain inequalities are removed by the inclusion of the charge for interest on investment. It adds to the value of the composite figures if they can be seen with and without this element of cost.

On the second matter, certain infractions of the general principles of accounting may arise if this charge for interest on investment is incorporated in the regular financial accounts. A profit may thereby be anticipated prior to actual sale of the goods, and inventory values may be correspondingly inflated. For these reasons there has been widespread opposition among accountants to the inclusion of this item in the regular financial books.

Must we then forego the business advantages because of the accounting difficulties? Not necessarily. Methods can be devised, within the books themselves, by which the undesirable effects may be eliminated. Furthermore, it is possible to prepare cost figures, including interest, without including them in the general financial books, though accountants for the most part prefer a tied-in system.

But the present discussion relates mainly to cost accounting as affected by the codes. The general problem of maintaining prices on a healthy basis will be helped by the inclusion of interest, and, in considering a complaint against a company accused of selling below costs, this factor should be considered as part of the evidence. But it does not seem necessary to make a hard and fast rule that every company shall keep its regular records on a basis including interest.

Depreciation Base and Method

The second very troublesome problem is depreciation. The great questions here are whether the periodic depreciation charge shall be computed upon the cost or replacement value and by the straight-line method or some other. The great majority of businesses, for financial accounting purposes, are doubtless figuring depreciation on original cost and by the straight-line method. This question has been discussed elsewhere (Chapter XII) and it has been pointed out that, where the circumstances of ownership of the business or changes in price levels have resulted in making the book cost values quite out of line with present replacement values, for cost purposes it is often desirable to use the latter for computing the depreciation charge. In considering a charge against a company of selling below cost, undoubtedly the depreciation should be reckoned on a replacement cost basis.

Total Delivered Cost

There has been some tendency, in speaking of cost under the codes, to think of it as consisting only of material cost plus direct labor charges. Such a concept cannot possibly suffice in this age of machine production and nationwide distribution. Not only must a heavy charge be included for manufacturing overhead; there are usually further heavy charges for selling and administrative overhead to be met, before a profit accrues to the business. The National Association of Cost Accountants hit the nail on the head when they specified that in no case shall "cost" include less than the total delivered cost.

Reports to the Regulating Authority

What has been said regarding the accounting systems to be kept by the individual business would naturally condition to a great extent the nature of the reports it may be called upon to furnish to a trade association or a governmental office. It is submitted that the most useful and reliable figures can be gathered from reports prepared on the basis indicated. If additional statistical figures are thought desirable, in addition to the reports drawn directly from the books of account, there can be no objection to that, but they should not be combined with the accounting reports in such a way as to obscure their primary purport.

The other main consideration on reports to be rendered is the sheer bulk of them. The volume and complexity of reports now required from public utilities are a very grave burden upon them; rather than add similar burdens to all industry it should be the steadfast purpose to simplify them. A determined effort ought to be made (1) to simplify the form and content of all required reports, and (2) to coordinate those required by different governmental departments to see how far they could be made identical or at least more alike.

Accounting Exhibits as Evidence

When it comes to hearing a complaint of breach of the code provisions, accounting statements prepared direct from the records would doubtless be submitted as evidence. But, as in public utility hearings in rate cases, much other evidence would also be required, and it is not desirable to change or extend the accounting records proper in a vain attempt to make them include everything that might be asked for by way of evidence in such cases. In a complaint about selling below cost, for example, it would certainly be material evidence to say not only what the costs actually are, as figured by the party complained of, but what they would be if figured with interest on investment and with depreciation computed on replacement values. It is doubtful, however, if any single set of figures would prove or disprove the complaint, which would have to be dealt with on broad and general lines. It would be futile to try to attack minute infractions of this rule; only major offenses could be taken cognizance of and such as would be reasonably easy to demonstrate. The cost figures of the offender himself would be examined to see if they had been prepared in accordance with the principles adopted by the association; if not, then new calculations would be made in accordance with those principles.

Securing Comparable Costs

Presumably the primary intent of the regulation against selling below cost is that a company shall not fix selling prices lower than its own cost of production. On this basis the question could be judged from the company's own figures by comparing its costs with its selling prices. But in practice most of the complaints are likely to be brought by competitor companies who compare the offender's selling prices with *their* costs and as a next step compare his costs with their own costs. Still more will it become necessary to compare costs of different producers, when it comes to determining how far companies shall be permitted to sell below their own costs to meet competition. In other words, it is inevitable that costs of different producers will be compared, in the efforts to enforce this provision.

Emphasis has been laid elsewhere on the necessity, in these circumstances, of having the cost figures prepared on the same basis, by the same methods and principles. There is one other important respect in which they should be comparable, namely, that the products made by the different companies shall themselves be identical. In some cases this will be easy to establish, but in many instances differences in the products will make it difficult to compare their costs. One of the defenses of a company complained of will be that its product is of a different quality or construction from that with which it is compared, and that these differences in the product justify the differences in cost—a line of argument which it will be difficult to combat. The general increase in standardization of products and prices will aid in this matter and should be further encouraged. It should not be impossible to establish comparable costs for comparable products, but this is one phase to which a good deal of attention will have to be given.

Costs and Selling Prices

The question has been raised whether, in its discouragement of selling below costs, the National Recovery Administration is going contrary to previous government policies and is approving or authorizing collective price fixing. Some color is given to this idea from the fact that the codes of some industries have included provision for minimum prices. A careful study of these codes does not, however, support the conclusion that price fixing as commonly understood is being favored by the government. The code for the lumber and timber products industry, approved on August 19, 1933, is an example in point, Article IX states that " . . . the Authority is authorized to establish and from time to time revise minimum prices. . . . " It should first be observed, however, that this clause occurs under the paragraph heading "cost protection," and in the supporting evidence it is shown that the peculiar conditions of the lumber industry, especially the problem of joint costs arising from cutting one and the same log into several different grades of lumber and the inability of many small mills to figure costs correctly, led to the adoption of this clause as the only means of safeguarding the situation. It is further to be noted that the allowed elements of cost are set forth in the same article in some detail, and it is specifically provided that "the weighted average minimum price of all items and classifications for each species shall not be more than cost of production. . . . " In other words, no selling price including a profit is being authorized here but only the use of the cost of production, ascertained according to the standards of the industry, as a minimum selling price. When it comes to be realized how very complex and varied the cost figures of different companies are, it may well be that the problem will be simplified by naming a minimum selling price, similarly defined, in other industries also.

Actual Differences in Cost

After all variables arising purely from methods of figuring the costs had been eliminated and cost figures computed on the proper and accepted methods had been secured, the authorities hearing the case would be confronted with actual differences of cost as between the respondent and the average of the industry; or at least there would be differences between the respondent and those who brought the complaint. There is no doubt that such actual differences do exist, although it is true that they would be much less than now appears if everybody figured their costs on a comparable basis. The hope that this comparable basis would eliminate all differences is, however, a vain one.

The administrative authority would then be confronted with the problem of determining a policy to be followed with respect to each of these several differences; in particular they would have to decide which of these differences justified a difference in the selling prices and which did not. On this matter the regulating authorities would encounter their most difficult problems of policy, as will be seen from a consideration of the following list of causes which would quite commonly occasion differences in cost between different producers:

1. Different degree of utilization of plant capacity.
2. Different degrees of efficiency in organization and management.
3. Acquisition of properties and plant at low prices.
4. Advantages or disadvantages arising from geographic location with regard to raw materials, labor markets, freight charges, or selling markets.
5. Specialization by a company on one product where other producers manufactured it in conjunction with other products.
6. Payment of lower wages than others in the same locality.

Other causes of different costs might arise but most cases would fall within one or other of the foregoing categories. A consideration of them will indicate the nature of the problems which arise under each.

Different Utilization of Plant Capacity

Suppose that some plants can average an operation of 75 per cent of their plant capacity all through the year, while other plants can only average 40 to 50 per cent. Or suppose some plants run three shifts, keeping the plant busy 24 hours a day, while others run only one shift with an operation of 8 hours per day. Other provisions of the code are designed to equalize, or at least to limit, working hours per man; in some cases the code prohibits excessive working hours for the plant, such as running three shifts per day. It is unlikely that the operation of the code can eliminate all differences of this sort, even though in some cases they fix a maximum; therefore, it will become necessary to decide how to treat the differences in cost which will be caused by this condition.

On this question it would seem that there is no alternative except for the industry as a whole to adopt a normal or standard rate of operation upon which costs shall be figured. After such a rate was adopted, the scale of operating expenses used would have to conform with it. That is, if the industry as a whole decides that 60 per cent of plant capacity is a proper rate on which to figure costs, and an individual plant is running at 75 per cent, then its actual expenses would have to be corrected to a 60 per cent operation in order to be comparable and before any complaint against them could be proved or disproved. A code may, and in some cases does, prohibit more than one shift, or two shifts, a day; some industries have placed restrictions on specific types of machinery; but no code can guarantee that a given plant would work more than one shift per day, or even that much. The prohibition would be against permitting individual plants to figure their costs on the basis of an extremely high degree of plant capacity utilized, thus giving themselves such low costs that selling prices based upon them would demoralize the industry. This being exactly what the codes are designed to avoid, the authorities could accomplish their purpose only by figuring from the general average conditions of the industry.

Here again, this does not necessarily imply that each company will in its own cost records for internal purposes figure on an average for the entire industry; rather it would be likely to figure on an average of its own experience. But if that company's conduct became the subject of complaint and a public hearing were held, it would seem that a conviction of the charge of selling below cost could only be sustained with reference to costs which were computed on an average degree of capacity utilized throughout the industry.

Efficiency in Organization and Management

It is not possible in practice to make a sharp separation between this situation and the last; a high degree of plant capacity utilized is likely to be the result of efficiency and alertness in management. But in this paragraph it is intended to deal with a different group of factors, namely, the actual expenses incurred for doing specific classes of work. If a company management possesses a superior skill in organization and in manufacturing technique, these will show themselves in lower unit costs on specific operations, resulting from better machinery, better methods, better planning and routing, or any other phase of management. Clearly it can never be a part of public policy to discourage this kind of ability; conceivably in some cases it might be slowed up as part of an intelligent policy of public regulation which did not wish to have changes take place too fast. But in the long run progress depends upon ability and enterprise of this sort and any wise society will encourage it. A company which had excelled in this respect would naturally have lower costs than other companies in its field; so long as it continued to sell above its own cost, it could not be convicted of selling below costs just because its selling prices were below the costs of its competitors. The more able management would not wish to fix selling prices at the lowest point that their own costs would permit, as they would not thereby be able to collect an adequate reward for their enterprise. Rather they would wish to see what prices were determined by the interaction of the entire supply and the entire demand, the entire supply including their own and that of less competent producers. In this way they would make extra profits, constituting a form of what economists have called "producers' surplus." It would then become the business of the regulating authority to permit price reductions based upon genuine efficiency in manufacturing, but not to the point of demoralizing the entire market. Since this policy would be in the interests of producers themselves, as well as serving the purposes of regulation, it might be expected to succeed.

Acquisition of Properties at Low Prices

In nearly every industry there are a number of companies which have acquired their manufacturing plants at very low prices, either in reorganization or by purchase. If the same owners continue to hold the properties at values reduced through a reorganization, they may be presumed still to have some incentive to recover their former losses by charging depreciation at rates at or near those required by the original values. A new owner who by purchase has acquired properties at very low cost does not have this particular incentive but yet may be presumed to wish to make all the profits he can and not give away to customers the whole benefit of his advantageous purchase. Nevertheless, it is certain that, when competition arises, owners of plants will in such circumstances feel that this is an opportunity for them to get ahead of their rivals and will begin to cut prices below the point where they cover depreciation computed on normal values. It will further be recognized that under the principles of accounting they are required, in their own records, to figure depreciation on the basis of the actual cost to them.

It is to meet situations of this sort that the proposal has been strongly urged that all companies should figure depreciation on the reproduction value of their plant. This proposal has been examined earlier and has been rejected as a basis for internal accounting. Nor is it desirable that reports made to the central authority should be solely on the reproduction value. It would be more informing to know what the actual depreciation charges are, as figured on the original cost; if in connection with this it could be ascertained how many plants are held by original owners at high values, and how many by new or reorganized companies at low values, the true picture of conditions in the industry would be clearer to the regulating authority. If any considerable proportion of the manufacturers in a given industry are in the latter category, with low fixed charges, it is a certain thing that they will tend to set correspondingly low selling prices, and relatively few people will thereby suffer. But if only one or two members of the industry are in this fortunate position, it would obviously be a mistake to permit them to jeopardize the economic well-being of the entire group by selling at prices which most of the other members could not possibly meet. This is another matter upon which the facts and conditions prevailing within the industry would have to be ascertained, so that a policy could be worked out which would give most of the reputable members a fair return.

Advantages of Geographical Location

A woodworking plant within the New York metropolitan area will be found at some disadvantage in competition with similar plants situated in the Middle West, on account of the lower labor rates which the latter enjoy. In so far as the New York company may be selling specialties or catering to individual tastes, it may overcome this handicap; but if they are all selling standard products, the disadvantage of the eastern company will be serious. This sort of thing is not completely removed by the minimum wage requirements of the code, if some companies are already paying wages well above those minimum requirements.

This is typical of a whole range of differentials which may arise from geographic location. Instead of labor it may be raw materials which the well-located company can purchase to advantage; or it may be power. The regulating authority will again be forced to adopt a policy with regard to these differentials and once more that policy will necessarily be based upon the broad economics of the industry. The aim should be to see to it that the representative companies of the industry, those whose production is necessary to furnish the required amount of that commodity, should be safeguarded and receive a fair price. But the regulating authority would find it impossible to guarantee net profits to those companies which were very poorly located; if they wanted to stay in the running, they would either have to accept a smaller return as net profits or find some compensating advantages which enabled them to offset their disadvantage.

Specialization on One Product

In a great many industries there are companies which manufacture a number of lines or varieties, their policy being to appeal to large groups of customers by offering them a considerable range of choice. Another motive for the same practice is the hope that activity in one line will compensate for dullness in another line, because the lines have different active seasons. Whatever be the reason for producing a mixed line, the attentions of the staff are divided, machinery and equipment are apt to be varied and miscellaneous, and the possibilities of long continuous runs are greatly curtailed.

Yet within the same industries there are usually companies which have specialized on one product or group of products, making it possible for them to concentrate all their manufacturing and selling efforts on one objective. Their machinery and equipment become more unified; their handling processes become standardized; their manufacturing orders become fewer in number but greater per order in quantity and value. If the costs of such a specialty company are compared with the costs of a similar product made by a variety company, where the product is but one of many, it is practically certain that the specialized company will show substantially lower costs. In the variety company there will be the problem of allocating overhead to different products, in such a way that product costs will be comparable with those of a specialty company making the same product.

Assuming that comparable cost figures have been secured, what attitude is to be taken toward the differences which will appear? What will a sound public policy require of these companies? It cannot very well forbid specialization; in spite of all its dangers, that is one of the major movements of our time and one by which many products are made available to masses of people who otherwise could not afford them. As long as the specialty company has computed its costs along sound and reasonable lines and does not sell below those costs, the fact that its costs are lower than those of other producers with a varied line does not justify intervention by the regulatory authority. It will have to be left to company managements to find out from their own experience whether specialization or varied production is the more advantageous, and those companies which believe in varied production will have to realize, on the other advantages they claim for it, sufficient to compensate them for any excess in manufacturing costs they may thereby incur. This is a matter in which, it would appear, industry will have to be left to develop its own policies and find its own level.

Profits and Selling Prices

In the process of determining whether or not a company has been guilty of selling below costs, much weight will naturally be attached to the company's periodic income statements. If these have been prepared in accordance with standard accounting practice and have consistently shown net profits earned, then the presumption is in favor of the company and against those who complain that its selling prices have been below cost. In the face of net profits earned the charge of selling below costs could not in any event be sustained with respect to a company's products as a whole but would have to be limited to some one or several products; to prove the charge with respect to them, it would be necessary to show either that the selling price on them was lower than the costs as computed by the company itself or else that these costs were wrongly computed. To support the last-named charge the complainants would in such circumstances have to demonstrate that there had been a wrong allocation of costs between products, resulting in the products complained of being favored with unduly low charges. Probably this would resolve itself into a discussion about burden allocation, since it is less usual for errors to be made with direct materials and direct labor charges.

Price Cutting to Meet Competition

Under the conditions described in the foregoing paragraphs there may be many occasions when a company will be selling above its own costs but below the costs of other producers of the same lines. These high-cost producers will then find it necessary, in order to maintain their position, to meet the prices of the low-cost producer and in so doing to sell below their own costs. This is exactly what takes place now, and it is difficult to see how any regulating authority can prevent it. The problem will then be upon the high-cost producers to improve their practice, and to bring themselves into line with their more able competitors. Unless the public authority is prepared to go much further than now seems contemplated, and to assume the responsibility of guaranteeing to make up losses of unsuccessful companies, or to undertake their direct management up to the extent of fixing prices for them, the only thing remaining is for the higher cost producers to bring down their costs or remain profitless until by competition they are eliminated from the field.

It is true that this condition will make it difficult for regulating authorities to distinguish between price cutting necessary to meet competition and downright price cutting of the vicious sort, but that is a problem which will have to be faced.

Actual Price Cutting

The final step will be reached when it has been demonstrated to the satisfaction of the authorities that a company has actually been selling below its own costs, and that this price cutting was not made necessary by market conditions in which more favorable producers were operating at lower costs. The offender, in other words, has been selling below his own or any other producer's cost. Even here there are likely to be two distinct stages: (1) where the selling prices cover all operating expenses except depreciation, (2) where the selling prices not only fail to cover all costs including depreciation but are less than the total operating expenses without depreciation. In the stress of competition there is a disposition among manufacturers to feel that they are free, for a time at any rate, to sell at prices which do not cover depreciation, provided they cover actually disbursed costs. It does not seem that the regulating authorities can properly countenance this idea. It is good sound business, as well as good accounting, to include a normal depreciation in operating costs; no program looking to recovery in fundamentals can ignore it.

It should, therefore, make no difference whether the price cutting consists merely of ignoring depreciation or goes further and eats into the cash disbursement costs; if price cutting is clearly established in breach of the terms of the code, the authorities will have to take some action. The law provides that the first step will be the securing of a cease and desist order from the Federal Trade Commission, forbidding the further use of the low prices complained of; if this fails, then recourse may be had to the criminal procedure sections of the code, in which heavy fines are provided. Beyond that, the licensing provisions might conceivably be called into use, under which, by withholding a license to operate, the authorities might entirely prohibit a company from doing business.

Progress By Cost Reduction

Careful consideration of the difficulties discussed in this chapter will suggest that it is not wise to prescribe too rigid rules against price cutting. Cost accountants are familiar with many cases where, by the aid of standard costs and budgets, costs of production have been continuously reduced over long periods of time, far beyond any point which had been thought possible. This is one form of industrial and economic progress. By the development of new materials, the invention of labor saving devices, better organization and planning, and changes in product design and construction, costs are in many industries constantly being lowered. The force of competition compels producers to give their customers the benefit of most of these cost reductions in the form of reduced prices. Attempts to interfere with this process are in most cases destined to failure. It is true that reckless price cutting in ignorance of cost is destructive; the difficulty is to draw regulations which will stop that sort of thing and yet permit price reductions which reflect the accomplishments of the more progressive elements in the industry.

XXVI

WALDRON PAPER COMPANY

This chapter contains a summary problem showing the records of a paper manufacturer, including general ledger, cost ledger, burden distribution, and complete summarizing and closing procedure for one month.

The Waldron Paper Company manufactured chiefly fine papers such as bonds, ledgers, cover stock and papeteries, and in addition a number of specialties.

The company operated five paper machines and 24 other production and burden centers, which produced all the various types of paper sold by the company. Twenty of these 29 production centers could be grouped into three major divisions in the process of manufacturing paper, namely, the rag preparation and conversion process, the paper-making process, and the paper-finishing process; the other nine were service or burden centers. In addition, the paper mill, through its cost office, took care of all the cost or industrial accounting.

Books Used

The financial accounting division kept the following books: (1) general journal, (2) trade sales analysis, (3) miscellaneous sales analysis, (4) accounts payable register, (5) check register and bank balance, (6) cash received register, (7) customers' ledger, (8) general ledger and cost control, and (9) a cost ledger. The general accounting books and the cost accounting books were kept in the same or adjacent offices; this enabled the two divisions of the accounting department to pass the books of original entry back and forth so that the various entries could be made in control or subsidiary records regardless of whether they recorded internal or external transactions. In addition it enabled the clerks of the two divisions of the accounting department to post the entries to the appropriate ledgers, either cost or general.

In this problem only the general journal will be used as a book of original entry. It is assumed that the student has in previous courses had ample practice in recording individual transactions in special columnar journals. All transactions for the month are therefore summarized here, in figures which correspond to what would be the totals of the special journal columns, if these were used. The student should record these summary or total figures in the general journal, after which full details of the costs will be given, including information for the distribution of burden, all to be entered in the general journal. This journal will contain four columns, two for the general ledger, and two for the cost ledger.

Cost Ledger Control

One account in the general ledger, called Inventory Control, Paper Mill, was the control account for the cost ledger. In this account therefore were summarized all the charges and all the credits to the factory, and its balance should agree, at the end of each month, with the total of all cost ledger balances.

A corresponding account called Inventory Control, General Ledger, was included in the cost ledger. Whenever it was required to debit an account in the general ledger, and credit an account in the cost ledger, it was necessary to go through the two control accounts. Thus the following entry would be wrong:

Coal	$500	
Accounts Payable		$500

This should be, in general ledger:

Inventory Control, Paper Mill	$500	
Accounts Payable		$500

and in the cost ledger:

Coal	$500	
Inventory Control, General Ledger		$500

General Ledger Accounts

The ledgers of the Waldron Paper Company contained 95 accounts; 45 were in the general ledger, and 50 were in the cost ledger. A list of the general ledger accounts, with the balances in them on February 1, is given in table on page 494.

In the company's full chart of accounts the following selling expense accounts were listed: Salaries, Traveling, Advertising, Office (which included fixed charges), Bad Debts Written Off, and Allowances on Sales; one account, No. 33, is used here to combine all of these and thus reduce the amount of detailed work. Under the caption Administration Expenses were listed accounts for Salaries, Traveling, Office (which included fixed charges), and Professional Services; these also have all

Trial Balance
General Ledger, February 1

1. Cash	$ 148,300	14. Wages and Salaries Accrued	$ 18,200
2. Accounts Receivable	350,100	15. Accounts Payable	65,100
3. Notes Receivable	70,200	16. Notes Payable	49,700
4. Investments	104,900	17. Taxes Accrued	10,000
5. Inventory Control, Paper Mill	469,000	18. Interest Payable Accrued	30,200
6. Inventory, Goods in Transit	4,350	19. Water Power Rent Accrued	3,000
7. Fixed Assets, Paper Mill	3,275,000	20. Preferred Dividends Payable	7,000
8. Other Fixed Assets	6,300	21. Reserve for Bad Debts	30,000
9. Construction in Process	5,650	22. Depreciation Reserve, Paper Mill	950,300
10. Insurance Unexpired	4,800	23. Depreciation Reserve, Other Assets	2,900
11. Interest Receivable Accrued	3,200	24. Bonds	1,000,000
12. Organization Expense	68,500	25. Preferred Stock	200,000
13. Patents, Copyright, Goodwill	50,000	26. Common Stock	1,500,000
		27. Surplus	598,300
		28. Current Profit and Loss	95,600
	$4,560,300		$4,560,300

Other Accounts in General Ledger

29. Regular Sales
30. Cost of Goods Sold
31. Sales Discounts
32. Outward Freight and Cartage on Sales
33. Selling Expenses
34. Administration Expenses
35. Interest Earned
36. Interest Charges
37. Special Income
38. Special Charges
39. Charges on Unused Space and Equipment
40. Interest Charged to Cost
41. Inventory Adjustment
42. Gain from Miscellaneous Sales
43. Purchase Discounts Not Taken
44. Earned or Unearned Burden
45. Reserve for Outward Freight and Cartage

been grouped in this problem under one heading, Administration Expenses, No. 34.

The Interest Charged to Cost account was credited with the interest figured on the fixed assets and was treated as a gain account.

Cost Ledger Accounts

The accounts in the cost ledger were as follows:

TRIAL BALANCE
COST LEDGER, FEBRUARY 1

1.	Rags	$ 64,000	
2.	Soda Pulp	28,000	
3.	Sulphite Pulp	49,000	
4.	Miscellaneous Pulp (includes Broke)	10,000	
5.	Shavings	13,500	
6.	Outthrows	2,500	
7.	Rosin	6,000	
8.	Soda Ash	2,000	
9.	Tub Size	4,000	
10.	Fillers	4,000	
11.	Other Chemicals	2,000	
12.	Color	2,000	
13.	Coal	18,000	
14.	Wires and Felts	30,000	
15.	Plater Books	3,000	
16.	Supplies	22,000	
17.	Dressed Rags in Process	2,500	
18.	Half Stock	15,000	
19.	Paper in Process	41,950	
20.	Reserve for Maintenance		$ 450
21.	Finished Stock	150,000	
22.	Inventory Control, General Ledger		469,000
		$469,450	$469,450

OTHER ACCOUNTS IN COST LEDGER

23. Raw Stock Handling and Storage
24. Rag Preparation
25. Rag Cooking
26. Rag Washing
27. Drainers and Stock Digging
28. Paper Pulping
29. Size Making
30. Paper Machine 1
    Paper Machine 2
    Paper Machine 3
    Paper Machine 4
    Paper Machine 5
31. Loft Drying
32. Calendering
33. Pasting and Ruling
34. Plating
35. Sorting and Counting
36. Trimming
37. Wrapping and Sealing
38. Finished Stock Storage
39. Water Supply
40. Steam
41. Power
42. Maintenance
43. Building Expense
44. Case Making
45. Trucking
46. Hospital
47. General Manufacturing Burden

Accounts 1 to 22 in the trial balance for the cost ledger were inventory accounts. Accounts 1 to 16 represented inventories of raw materials and supplies; Accounts 17, 18, and 19 were for three stages of work in process, and Account 21 was the Finished Goods account. All these accounts normally carried balances at each month end.

All of the accounts from 23 to 47, inclusive, were process cost accounts which were closed out at the end of each month.

The first four accounts, 23 to 26, inclusive, were closed into Dressed Rags in Process, while the accounts from Drainers and Stock Digging to and including Finished Stock Storage were closed into the Paper in Process account. Accounts 39 to 47 represented indirect or service departments and were redistributed on the burden distribution sheet to the 20 direct producing departments.

In the figures accompanying this problem the five paper machine centers are for convenience combined into one. In actual practice they were always kept separate because the costs on different machines—no matter how similar—tended to vary considerably.

Transactions to Be Recorded

The transactions for the month of February were as given below:

Set up the general ledger accounts, and enter in the proper accounts the balances given in the trial balance.

Set up the cost ledger in the same manner.

Make the journal entries necessary to record the transactions given, using a four column journal as already described.

Post these entries to the general and cost ledgers.

SALES

The sales analysis book showed the following totals for the period:

Sales	$270,500
Sales Discount	5,300
Outward Freight and Cartage	1,600*
Allowance on Sales	800

* Outward Freight and Cartage was an estimated amount of the allowance to be made to customers; credit Reserve for Outward Freight and Cartage. When customers take the actual deductions, credit Accounts Receivable and debit Reserve. Then close Reserve into Outward Freight and Cartage, and the latter into Sales.

The sales of $270,500 were on account and were gross. Discount, Outward Freight and Cartage, and Allowance on Sales were to be deducted, in order to show net sales. The cost of sales, as summarized from the sales sheets, was $236.425.

PURCHASES

The accounts payable register shows the following total purchases for the month:

Rags	$ 58,600
Sulphite Pulp	29,000
Soda Pulp	16,000
Shavings	8,000
Tub Size	2,700
Rosin	3,400
Filler	3,500
Color	1,100
Wire and Felt	6,500
Coal	7,900
Supplies	5,800
Plater Books	500
Total	$143,000

CASH BOOK TOTALS

Received:	
On Accounts Receivable	$302,900
Notes Receivable	35,100
Interest on Investments	600
	$338,600
Disbursed:	
Accounts Payable	$125,200
Notes Payable	2,500
Direct Labor (charge Wages and Salaries Accrued)	21,200
Indirect Labor (charge Wages and Salaries Accrued)	57,100
Selling Expenses	18,300
Administrative Expenses	10,600
Insurance	15,750
Preferred Dividends	7,000
Interest	32,100
Water Power Rent	3,100
	$292,850

ACCRUALS AT FEBRUARY 28

Interest Payable	$5,065
Interest Receivable	250

The Interest Payable amount of $5,065 was to be debited to Interest Charges and the Interest Receivable amount was to be credited to Interest Earned.

The actual allowance to customers on Outward Freight and Cartage was found to be $1,600 for the period.

During the month of February the Waldron Paper Company produced a considerable amount of paper; the material, labor, and burden costs for this production are given under appropriate titles in the following pages. Enter these in the journal and post the entries.

Material Costs

The materials used were determined by summarizing the various cost sheets which had been worked on during the period.

MATERIALS USED

Material account	Charged to	
	Paper in Process	Dressed Rags in Process
Rags	2,000	60,480
Sulphite Pulp	34,220	
Soda Pulp	12,000	
Miscellaneous Pulp	2,000	
Shavings	1,000	7,000
Tub Size	3,750	
Fillers	4,200	
Rosin	3,000	
Plater Books	1,025	
Color	550	
Chemicals	100	400
Soda Ash	....	800
Half Stock	97,356	
Totals	161,201	68,680

The various material accounts were credited, and the two process accounts were debited, for the amounts shown.

During the period there were $2,500 in Outthrows, $4,750 in Shavings, and $1,500 in Broke shown as credits on the cost sheets. The Outthrows were credited to Dressed Rags in Process and the Shavings and Broke to Paper in Process. The debits were made to Outthrows, Shavings, and Miscellaneous Pulp (broke).

The Lot Cost Sheets showed that a total of $246,843 of paper had been finished and stored or shipped.

Direct Labor Costs

The direct labor charges for the month of February amounted to $18,676, this sum being made up from the departmental charges shown in table on page 499.

A journal entry for the cost ledger was made charging the proper departments with these amounts and crediting the Inventory Control, General Ledger, account for their total. Another journal entry was made for the general ledger in which

Department	Number of employees	Labor cost
Rag Preparation	60	$ 4,670
Calendering and Hot Rooms	30	3,001
Plating	72	7,216
Sorting	39	3,789
Total	201	$18,676

the Inventory Control, Paper Mill, account was charged and the Wages and Salaries Accrued account was credited for the total amount.

Burden

Prepare a burden distribution sheet from the following information. Burden was accumulated on a basis of 13 four-week periods, the burden distribution sheet used containing columns for the following items:

1. Fixed Charges.
2. Indirect Labor.
3. Supplies.
4. Maintenance.
5. Water Supply.
6. Steam, Demand.
7. Steam, Consumption.
8. Power.
9. Building Expense.
10. Hospital.
11. General Manufacturing.
12. Case Making.
13. Trucking.
14. Total Charges.

The departments, both direct and indirect, were listed down the side of the sheet. These departments are shown in the distribution of fixed charges, page 501.

Fixed Asset Summary

The information for the Fixed Charges column in the burden distribution sheet was computed from the following data:

		Value
Land		$ 52,300
Buildings		1,211,250
Building Fixtures		58,700
Machinery and Equipment		1,692,000
Belting and Small Tools		31,550
Automotive Equipment		49,200
Office Furniture and Fixtures		16,100
Water Rights		163,900
Average Inventories:		
Raw Materials	$249,100	
Work in Process	62,000	
Finished Goods	140,000	451,100
Total		$3,726,100

Taxes, Interest, Insurance, and Depreciation on the foregoing were computed on a yearly basis, the rates being:

	Percentage
Taxes	1.5
Interest	6.0
Insurance	0.1
Depreciation, Buildings	2.5
Fixtures	7.5
Machinery	5.0
Automotive Equipment	25.0
Office Equipment	10.0

The assets listed were divided into three parts for convenience and a fixed charge factor for each was computed thus:

SUMMARY OF FIXED CHARGES

	Value	Interest	Taxes	Insurance	Depreciation	Total
I. Land and Building Factor:						
Land	$ 52,300	$ 3,138	$ 785	......	....	$ 3,923
Buildings	1,211,250	72,675	18,169	$ 1,211	$ 30,281	122,336
						$126,259
II. Equipment Factor:						
Building Fixtures	58,700	3,522	880	59	4,403	8,864
Machinery and Equipment	1,692,000	101,520	25,380	1,692	84,600	213,192
Belting and Small Tools	31,550	1,893	473	32	....	2,398
Automotive Equipment	49,200	2,952	738	49	12,300	16,039
Office Furniture and Fixtures	16,100	966	242	16	1,610	2,834
						$243,327
III. Miscellaneous Charges:						
Water Rights	163,900	9,834	2,458	......	....	12,292
Average Inventories:						
Raw Material	249,100	14,946	3,737	249	....	18,932
Work in Process	62,000	3,720	930	62	....	4,712
Finished Goods	140,000	8,400	2,100	140	....	10,640
Other Insurance	......	....	....	24,831	....	24,831
						$ 71,407
Totals	$3,726,100	$223,566	$55,802	$28,341	$133,194	$440,993

The annual fixed charges for the three factors Land and Buildings, Equipment, and Miscellaneous were grouped into one total for each department. The departmental totals were then divided by 13, the number of periods used in a year, to obtain the periodic charge to be entered in the Fixed Charges column of the burden distribution sheet. The final column in the schedule shown on page 501 gives these figures.

The figures in the last column (page 501) were entered in column 1 of the burden distribution sheet.

DISTRIBUTION OF FIXED CHARGES

Department	Land and Buildings	Equipment	Miscellaneous	Annual charge	Periodic charge
1. Raw Stock Handling and Storage	$ 22,215	$ 1,015	$20,355	$ 43,585	$ 3,353
2. Rag Preparation	9,721	7,542	600	17,863	1,374
3. Rag Cooking	2,480	7,093	182	9,755	750
4. Rag Washing	2,012	8,201	249	10,462	805
5. Drainers and Stock Digging	5,309	10,333	153	15,795	1,215
6. Paper Pulping	961	2,269	87	3,317	255
7. Size Making	1,572	2,269	90	3,931	302
8–12. Paper Machines 1 to 5	13,025	82,225	1,356	96,606	7,431
13. Loft Drying	18,245	2,893	599	21,737	1,672
14. Calendering and Hot Rooms	5,281	11,753	532	17,566	1,351
15. Pasting and Ruling	1,304	972	122	2,398	184
16. Plating	1,569	7,100	919	9,588	738
17. Sorting and Counting	2,564	1,199	750	4,513	347
18. Trimming	555	3,432	115	4,102	316
19. Wrapping and Sealing	105	81	100	286	22
20. Finished Stock Storage and Shipping	15,466	592	9,376	25,434	1,956
21. Maintenance	1,716	2,811	722	5,249	404
22. Water Supply	311	17,255	....	17,566	1,351
23. Steam—In Buildings	....	18,767	943	23,689	1,822
Coal Storage	3,979				
24. Power	5,312	24,296	5,128	34,736	2,672
25. Building Expense	205	10,699	79	10,983	845
26. Hospital	1,205	201	33	1,439	111
27. General Manufacturing Burden	5,938	2,167	20,881	28,986	2,230
28. Case Making	793	82	85	960	74
29. Trucking	399	14,697	461	15,557	1,197
30. Unused Space and Equipment	1,433	1,244	....	2,677	206
31. Selling	759	628	30	1,417	109
32. Administration	1,825	1,511	7,460	10,796	831
Total	$126,259	$243,327	$71,407	$440,993	$33,923

The individual figures giving the periodic fixed charge total of $33,923 formed the debit to the standard periodic journal entry, the offsetting credits being to:

Interest Charged to Cost	$17,197	
Taxes Accrued	4,300	
Insurance Unexpired	2,180	
Reserve for Depreciation	10,246	$33,923

These items were not, however, entered as a separate journal entry but, along with all the following items of burden, were entered as part of two journal entries prepared from the burden distribution sheet, and containing the entire record for the distribution of the burden to the ledger accounts.

At the end of 13 periods these credits equaled the yearly charges.

Indirect Labor

The Indirect Labor charges and number of indirect employees in each department were as follows:

Department	Number indirect employees	Indirect Labor
Raw Stock Handling and Storage	9	$ 1,041
Rag Preparation	2½	409
Cooking	12½	1,552
Washing	18	2,136
Drainers and Stock Digging	12	1,394
Paper Pulping	6	687
Size Making	6	731
Paper Machines 1–5	75	12,421
Loft Drying	42	4,911
Calendering and Hot Rooms	10½	1,454
Pasting and Ruling	12	975
Plating	4½	671
Sorting	19½	3,880
Trimming	7½	1,012
Wrapping and Sealing	9	844
Finished Stock Storage and Shipping	6	841
Maintenance	27¼	4,726
Steam	21	2,739
Power	3¾	779
Building Expense	6	831
Hospital	2	291
General Manufacturing Burden	18	4,540
Case Making	6	729
Trucking	7	989
Total	343	$50,583

The amounts in the foregoing schedule were entered in column 2 of the burden distribution sheet.

Supplies Used and Distributed

The Departmental Supply charges were:

Departments	Total Charges	Departments	Total Charges
Paper Machines 1 to 5	$2,692	Power	$ 2,893
Pasting and Ruling	291	Building Expense	213
Wrapping and Sealing	1,217	Case Making	3,010
Finished Stock Storage and Shipping	405	Trucking	275
Maintenance	1,411	Total	$21,259
Water Supply	425		
Steam	8,427		

The foregoing amounts were entered in Column 3 in the burden distribution sheet.

These supplies, as determined by a physical inventory, which were charged to Paper in Process through the burden distribution sheet as shown in table on page 501.

Wires and Felts	$ 2,500
Water Power Rent	2,780
Chemicals	375
Coal	8,232
Supplies	7,372
Total	$21,259

The Water Power Rent was disposed of by crediting the Water Power Rent Accrued account in the general ledger, via the control account in the cost ledger.

Redistribution of Burden Departments

The entire burden charges have now been entered in the first three columns, and it is necessary to proceed to the redistributions. This is done by adding up the horizontal amounts charged to each indirect department account. Maintenance comes first, for example; on line 21 are charged the amounts of $404, $4,726, and $1,411, a total of $6,541. This is distributed as shown below.

Maintenance and Water Supply

The Repairs and Maintenance, and Water Supply costs amounted to $6,275 and $2,021, respectively, and were distributed to the various departments in the manner shown in table on page 504.

The $6,275 distributed as Repairs and Maintenance charge was the estimated normal expense. The actual total charges for this period already made to Maintenance amounted to $6,541. The difference of $266 was charged to Reserve for Maintenance. This also was entered on the general burden distribution sheet, under the total for column 4.

Steam Distribution

Steam costs were distributed upon the basis of normal demand, and actual consumption. The demand charges were related directly to the size of the steam plant and included the Fixed Charges, Indirect Labor, Miscellaneous Supplies, and

Departments	Repairs and Maintenance	Water Supply
Raw Stock Handling and Storage	$ 80	
Rag Preparation	350	
Cooking	80	$ 101
Washing	425	1,010
Drainers and Stock Digging	70	
Paper Pulping	20	61
Size Making	80	61
Paper Machines 1 to 5	1,055	505
Loft Drying	80	
Calendering and Hot Rooms	490	
Pasting and Ruling	50	81
Plating	215	
Sorting	30	
Trimming	120	
Wrapping and Sealing	30	
Finished Stock Storage and Shipping	120	
Water Supply	245	
Steam	475	202
Power	865	
Building Expense	240	
Hospital	25	
General Manufacturing Burden	65	
Case Making	40	
Trucking	125	
Total	$6,275	$2,021

Maintenance. The consumption charges were for coal and water. The steam plant operated only when there was no water to furnish power. Upon the average the steam plant was used 70 days per year, and upon this fact a standard daily charge amounting to $199.32 was made to the power plant for the steam supplied for each day that the steam power plant was used. In February there were four such days.

The total charges to the steam department amounted to $13,665, out of which $4,471 was distributed on the demand basis and $797 was transferred to power on the basis given above (4 × $199.32), leaving $8,397 to be distributed according to consumption percentages, as shown in table on page 505.

Power, Building Expense, and General Manufacturing

Power, Building, and General Manufacturing expenses were distributed to departments in the amounts as shown on the next page. Before distributing the General Manufacturing Expense, the entire amount of Hospital charges, amounting to $459, was transferred to it.

Departments	Distribution of periodic demand charges	Distribution of periodic consumption charges (except power)	
Cooking	$ 152	3.4%	$ 286
Paper Pulping	6	0.1	8
Size Making	10	0.5	42
Paper Machines 1 to 5	1,496	69.7	5,853
Loft Drying	338	20.0	1,679
Calendering and Hot Rooms	51	0.7	59
Pasting and Ruling	25	0.3	25
Power	2,304	....	797
Building Expense	89	5.3	445
Total	$4,471	100.0%	$9,194

The Power and Building Expense percentages given were applied to the charges which had already been accumulated on lines 24 and 25, respectively, thus giving the dollar amounts shown in the following table.

Departments	Power		Building Expense		General Manufacturing Expense
Raw Stock Handling and Storage	0.3%	$ 31	18.1%	$ 481	$ 141
Rag Preparation	2.1	216	11.7	312	998
Cooking	0.7	72	1.6	43	201
Washing	22.2	2,289	5.0	133	291
Drainers and Stock Digging	0.7	72	3.2	85	194
Paper Pulping	2.0	206	0.6	16	97
Size Making	......	....	1.6	43	97
Paper Machines 1 to 5	64.9	6,691	9.5	253	1,199
Loft Drying	......	....	14.1	376	670
Calendering and Hot Rooms	4.2	433	5.3	141	648
Pasting and Ruling	0.2	21	1.2	32	194
Plating	1.6	165	1.7	45	1,222
Sorting	......	....	2.9	77	931
Trimming	0.7	72	0.6	16	119
Wrapping and Sealing	......	....	0.1	3	141
Finished Stock Storage and Shipping	0.2	21	15.0	399	97
Steam	......	....	......	......	....
Hospital	......	....	1.2	32	....
General Manufacturing Burden	......	....	5.8	155	....
Case Making	0.2	21	0.8	21	97
Trucking	......	....	......	......	112
Total	100%	$10,310	100%	$2,663	$7,449

General Manufacturing Expense was distributed on the basis of the number of direct and indirect employees in each department, as given on pages 499 and 502. There was some difficulty in closing this item because of the "vicious circle." Parts of the General Manufacturing Expense ought to be distributed to Steam, Power, Maintenance, Building Expense, and Hospital departments, but all of these were already closed. The simplest way, therefore, to distribute General Manufacturing Expense was to consider the number of laborers in those departments only that remain open. After making these necessary adjustments the distribution of General Manufacturing Expense was as given in the preceding table.

Burden was redistributed in the order in which the columnar headings were given on page 499. The entire amount of Case Making expense was transferred to Finished Stock Storage; and Trucking expense was distributed to Raw Stock Handling, Plating, Sorting, and Finished Stock Storage in the percentages of 50, 5, 10, and 35, respectively. The horizontal totals should then be inserted in column 14.

The burden distribution sheet was now complete and from it should be prepared the journal entries to record the distribution in the books. There were two of these entries: the first debited all the direct departments with the total charges to them, crediting the sources of these charges, mostly in the general ledger; the second debited the service or burden departments with the amounts allocated to them and then credited them with the same amounts to show the redistribution.

The three items given at the bottom of the sheet, namely, Unused Space and Equipment, Selling, and Administration, although given on the Burden Distribution Sheet, were not distributed to the producing departments. They were cleared through the Inventory Control, General Ledger, account to the General Ledger, where they were charged to the three accounts concerned, Numbers 39, 33, and 34.

Burden Rates

The burden rates used in the various departments and basis of their application were as shown in table on page 507.

These rates were applied to the proper figures in the various departments to obtain the Burden Earned amounts presented below. The Raw Stock Handling burden was applied to all

Departments	Rates
Raw Stock Handling and Storage	$ 0.20 per 100 lb.
Rag Preparation	0.50 per 100 lb.
Rag Cooking	31.20 per bleach
Washing	0.95 per machine hour
Drainers and Stock Digging	0.55 per 100 lb.
Paper Pulping	0.50 per 100 lb.
Size Making: Rosin	0.04 per pail
Glue	0.02 per pound
Paper Machines 1 to 5	1.50 per 100 lb. 11.70 per machine hour
Loft Drying	0.70 per 100 lb.
Calendering and Hot Rooms	147% of direct labor
Pasting and Ruling: Pasting	$3.42 per machine hour
Ruling	1.65 per machine hour
Plating	43% of direct labor
Sorting (including Counting)	145% of direct labor
Trimming	$1.30 per machine hour
Wrapping and Sealing	2.00 per trimming hour
Finished Stock Storage and Shipping	0.70 per 100 lb.

bulk materials and also to the filler used. The burden charge for the drainers and stock digging center was applied on the basis of the pounds of bone-dry stock as determined by applying an average shrinkage factor to the quantity of dressed rags or shavings shown on the beater reports. The rate per pound on the paper machines was applied to the corrected loft weight.

Burden Earned

The amounts of Burden Earned at the foregoing rates, during the month of February for the various departments is given next:

Departments	Amounts	
Raw Stock Handling	$ 6,336	
Rag Preparation	3,710	
Cooking	3,201	
Washing	6,966	$ 20,213
Drainers	3,211	
Paper Pulping	1,353	
Size Making	1,447	
Paper Machines 1 to 5	39,695	
Loft Drying	9,222	
Calendering	4,332	
Pasting and Ruling	1,919	
Plating	3,208	
Sorting and Counting	5,499	
Trimming	1,538	
Wrapping and Sealing	2,103	
Finished Storage and Shipping	8,993	82,520
Total		$102,733

The Burden Earned was determined by summarizing the various cost sheets begun and completed during the period. The first four items were charged to Dressed Rags in Process and the others to Paper in Process, the credits being to the departmental burden accounts listed. This entry was made at this point.

At the end of the period $2,025 of Dressed Rags in Process remained as inventory; the balance of this account was transferred to Half Stock.

Post all the entries now contained in the journal to the proper ledger accounts.

Close the two ledgers by journal entries, and take off a trial balance from each ledger, after closing.

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